FINAL REPORT

Example Allocations of Operating and Maintenance Costs of Interstate Water Control Facilities Employing the Use-of-Facilities Method

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1.0 PROJECT AUTHORITY

As part of the USAID sponsored EPIC program, assistance is being provided to the Executive Committee of the Interstate Council for the Republic of Kazakstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan (ICKKTU) to develop regional principles on financing of operation and maintenance (O&M) of international (transboundary) water facilities of the region.

The lack of funds for O&M of transboundary water facilities is a principle underlying cause of severe water mismanagement in the region. With the transition to market-based institutions, pricing schemes and other new approaches are being developed which may be used to generate revenues for routine O&M investments. The ability to recover such costs is also a precondition to most external financing of water related investments.

The facilities considered here include transboundary water facilities of regional river basins, including interstate rivers, canals, and collectors. These facilities, which form the backbone of water management systems in Central Asia, have deteriorated rapidly since the collapse of the Soviet Union and they are in severe need of basic O&M repairs. The various water management authorities dealing with the transboundary facilities of Central Asia are well aware of the need for more integrated management and greater financing for O&M in order to resolve these problems.

An agreement was entered into in March of 1998 by the Republic of Kazakhstan, the Kyrgyz Republic, and the Republic of Uzbekistan on the Use of Water and Energy Resources. (March 1998 Interstate Agreement) The Republic of Tadjikistan became a party to the agreement in June of 1999. That agreement did not specify how O&M funding would be generated. One of the economic issues that may constitute potential constraints to the full implementation of the Interstate Agreement identified is determining what cost sharing arrangements are appropriate for operation and maintenance of common hydro-technical structures. A paper on principles of sharing operation and maintenance costs of transboundary facilities was submitted at the August,1999, Water and Energy Uses Roundtable meeting.[1] That paper presented a general cost allocation model based on the use-of-facilities principle.

The participants of the Roundtable Meeting showed keen interest in that work and noted their need for practical cost sharing principles. They encouraged USAID to extend to another phase where 3 or 4 different types of facilities would be analyzed to demonstrate the applicability of the model to a range of facilities with different characteristics. A list of the types of transboundary facilities to be analyzed follows:

- An irrigation canal facility.
- A water supply reservoir.

[1] Hutchens, Adrian O., Regional Principles of Sharing Operation and Maintenance of Shared Water Facilities, EPIC Project, Central Asia Mission, USAID, August, 1999.

- A multiyear water supply and hydroelectric generating facility; and
- A seasonal re-regulation water supply and hydroelectric generating facility.

Through consultations between EPIC Program Team Leader and representatives of the Committee on Water Resources of the Ministry of Agriculture of The Republic of Kazakhstan, the Department of Water Economy of the Ministry of Agriculture of the Kyrgyz Republic, JSC "KyrgyzEnergo", Ministry of Amelioration and Water Economy of the Republic of Tajikistan, and State JSC Barki Tochik, the following interstate facilities were selected for applying the use-of-facilities method of cost allocation for example illustrative purposes:

- West Big Chu Canal, in the Kyrgyz Republic, a component of the Chu River system serving the Kyrgyz Republic and Kazakhstan;
- Chon Kakpah Reservoir on the Talas River in the Kyrgyz Republic, serving the Kyrgyz Republic and Kazakhstan;
- Toktogul Reservoir and the associated Uch-Kurgan re-regulation reservoir in the Kyrgyz Republic, a multiyear water supply and hydroelectric generating facility serving the Kyrgyz Republic, Tadjikistan, Uzbekistan, and Kazakhstan; and
- Kairakum Reservoir in Tadjikistan, a transboundary seasonal re-regulation water supply and hydroelectric generating facility serving Tadjikistan, Uzbekistan, and Kazakhstan.

The Chu and Talas river systems can be analyzed separately since they are clearly independent of each other. However, that is not the case with Toktogul and Kairakum reservoirs.

Toktogul and Kairakum reservoirs can not realistically be analyzed separately since they are so interdependent. Toktogul is a major water suppy and hydroenergy reservoir on the Naryn River which is a major tributary to the Syr Darya River. Kairakum, which is on the mainstem downstream from the confluence of the Naryn and Syr Darya Rivers, is arguably the principal reregulation and water distribution reservoir in the Syr Dary Basin. They, along with Andijan, Charvak, and Chardara reservoirs, constitute the primary transboundary facilities that must be operated as a coordinated unit in order to attain mutually beneficial use of the water resources of the basin. The operational mode of each is influenced by and dependent upon the operational modes of the others. Khamidov and Leshanskiy present a compelling argument for the joint operation of these transboundary facilities.[2]

[2] See "Review of the Proposal of Constructing an Operation Model for Kairakkum Reservoir" in Appendix E.

2.0 PROJECT PURPOSE

The purpose of this paper is to illustrate how the UoF method of cost allocation can be used to allocate O&M costs of facilities that have a wide range of operating characteristics and purposes. Before proceeding with the example allocations, a rationale for using the UoF method is presented followed by a general mathematical model. A simple hypothetical example is then presented to provide the reader with a conceptual foundation before addressing the more complex specific example allocations.

3.0 RATIONALE FOR USING THE USE-OF-FACILITIES METHOD

When governments undertake the implementation of multipurpose projects, the problem of how to allocate the cost of the projects among the various beneficiaries invariably arises. The most common method utilized is one that allocates costs among the various purposes in proportion to the value of the benefits produced by each purpose. The most thorough application of that concept is found in the *separable cost-remaining benefits* method, which was developed by the U.S. Inter-Agency Committee on Water Resources with support from the Stanford Research Institute.[3,4] It is commonly used in the international scene, most likely due to its recommendation by the World Bank.[5] However, one must be conscious of the setting in which these recommendations have taken place.

Each reference recommending use of a benefits-based cost allocation takes place in a planning setting. That is, a setting where the project in question has not yet been built, and the plans of what to build, if anything, are being formulated. No irreversible commitments have yet been made, and all options are still open. In that planning setting, a benefits-based method of allocation is appropriate since it will ensure attainment of the most economically efficient project. However, that is not the setting in which this investigation takes place. The interstate water facilities in question have already been built and are in need of upgraded O&M funding. Irreversible commitments have been made and, therefore, no realistic alternatives to the present facilities exist. In this setting, a benefits-based allocation method could result in undesirable effects, which can be illustrated with a hypothetical example.

Suppose there is an irrigation project that serves two areas, Area A and Area B. For simplicity, let's further suppose that A and B are equal in size and productivity and receive equal amounts of water. The original benefits-based cost allocation, conducted

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3 U.S. Inter-Agency Committee on Water Resources, "Proposed Practices for Economic Analysis of River Basin Projects," May 1950; revised May 1958.

4 Stanford Research Institute, "Economic Considerations in the Formulation and Repayment of California Water Plan Projects," March 1958.

5 Gittinger, J. Price, "Economic Analysis of Agricultural Projects," Economic Development Institute of the World Bank, Johns Hopkins Press, Baltimore, 1982.

during the planning phase, resulted in each area paying the same amount for initial construction and future O&M per unit of water delivered. Now, let's suppose considerable time has gone by, several years at least, and the water users in Area A have changed their irrigation practices by adopting more modern techniques. As a result, productivity of their land has increased by 50%. In the meantime, water users in Area B have continued with their original irrigation practices which have resulted in a high water table and increasingly saline soil to the extent that their productivity has decreased by 50%.

Suppose further that an argument is put forward that the costs should be reallocated because of the difference in benefits being realized between the two areas. A reallocation of costs based on benefits would result in Area A water charges increasing 50% per unit of water and Area B water charges decreasing by 50% per unit of water, which would mean Area A is paying three times more per unit of water than Area B. An argument could be mounted that this is fair since Area A is realizing three times the benefit. However, a rather compelling counter argument also could be mounted. Water users in Area A, on their own initiative, have exercised good management practices and have increased the efficiency and productivity of their irrigation system while water users in Area B, on their lack of initiative, have continued with inefficient practices that have led to the reduced productivity of a valuable natural resource. In that situation, the application of a benefit-based cost allocation method would penalize the good managers in Area A and would reward the poor managers in Area B. That seems incongruous with the increasing need for conservation of a scarce and precious natural resource such as water.

If the UoF method of cost allocation had been used, costs would remain evenly divided and the good managers in Area A would reap the rewards of their good management practices, as they should, and the poor managers in Area B would suffer the losses stemming from their poor management practices, as they should.

A more direct reason for using the UoF method of allocating O&M costs of the interstate water facilities is that the UoF method seems to be the main principle emerging from ongoing interstate negotiations. This principle is specified in the Protocol of the Commissions of Water Committee in the Ministry of Agriculture, Republic of Kazakhstan, and Water Department in the Ministry of Agriculture and Water Management, Kyrgyz Republic, where it is specified that these costs shall be shared "… in proportion to amounts of water supplied."[6] It is also specified in Article 3 of the draft agreement between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan, where it is stated that, "In the joint use of water resources from the shared interstate water facilities the Parties shall agree to recover the costs

[6] PROTOCOL of the Meeting on Operation of Interstate Water Facilities Jointly Used in the Chu and Talas Basins, Commissions of Water Committee in the Ministry of Agriculture, Republic of Kazakhstan, and Water Department in the Ministry of Agriculture and Water Management, Kyrgyz Republic, 11 March 1999, Bishkek. In Appendix E.

associated with operation, maintenance, capital repair and reconstruction of the facilities in proportion to the water received (share percent of each country).[7]

4.0 GENERAL MATHEMATICAL USE-OF-FACILITIES MODEL

This model is limited to allocating O&M costs when there are no outstanding capital recovery obligations for any of the transboundary facilities; therefore there are no capital costs associated with those facilities to allocate. Of course, future capital costs for new facilities or capital improvements to existing facilities can be allocated when those facilities are being considered for implementation by including annualized costs of the capital improvements.

The water supplies received by each Republic are treated in total amounts received rather than separating them according to the respective functions served. For example, within Kazakhstan water is distributed for irrigation, industrial use, municipal use, fisheries, and water transportation. How, when, or if the water supply received is allocated to these functions is an internal matter for each Republic to address according to their own national policies.

The general UoF allocation model consists of two submodels. The first submodel is used to isolate the cost of consumptive water supply functions, such as irrigation, by subtracting the costs associated with non-consumptive water supply functions such as hydro-energy, recreation, social development, etc. The second submodel allocates the remaining consumptive water supply functions to the Republics receiving the water.

4.1 SUBMODEL FOR DERIVING ALLOCATABLE COSTS

The O&M costs to be allocated can be identified by subtracting out the separable costs for all non-water supply functions from the total O&M costs for the facilities. The remaining costs are the costs that must be allocated between the Republics. That process is represented by the following formula:

$$C_A = C_T - (S_P + S_E) \qquad (1)$$

where C_A = water supply O&M costs to be allocated
C_T = total O&M costs for the facility in question
S_P = separable hydro-energy O&M costs
S_E = other non-water supply function O&M costs.

Equation 1 ensures that only O&M costs directly related to supplying water to the Republics will be allocated.

[7] Draft AGREEMENT Between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan, prepared by the Government of the Kyrgyz Republic and presented to the EC of the ICKKTU in 1998, unsigned and undated. In Appendix E.

4.2 *SUBMODEL FOR ALLOCATING COSTS TO THE REPUBLICS*

After subtracting the separable non-water supply costs, the remaining costs, which should be only those O&M costs related to providing water supply, are then allocated to the Republics in proportion to the water received. The resulting allocation to each Republic is

$$C_{Ri} = C_A \left(W_{Di} / W_T \right) \tag{2}$$

where C_{Ri} = water supply O&M cost allocated to Republic i,
W_{Di} = water supply received by Republic i, and
W_T = total water supply delivered to all Republics.

Subject to $$\sum C_{Ri} = C_A \tag{3}$$
and $$\sum \left(W_{Di} / W_T \right) = 1.0 \tag{4}$$

Equation 2 ensures that those costs will be allocated in proportion to the amount of water received. Equations 3 and 4 ensure that all of the water supply O&M costs will be allocated to the receiving Republics. It should be noted that this model automatically allocates O&M costs associated with managing all waters passing through the facilities. For the Syr Darya River transboundary facilities example allocations, that includes waters that are released to the Aral Sea and to non-productive side locations such as the Arnasai depression.

If delivery of water to the Aral Sea is assumed to be a joint responsibility of all of the Republics in the basin, and water spilled to Arnasai is assumed to be the collective result of management, or mismanagement of the system, which is also the joint responsibility of all of the Republics, it seems equitable that the costs of managing those waters should be allocated among the Republics.

The costs of managing those waters are real and should be addressed equitably. Those releases are not included as specific water deliveries (W_{Di}) by this model, but they are included in the total water supply provided by the transboundary facilities (WT) and the cost of managing those waters is included in the total water supply O&M cost (C_A). Therefore, since the sum of the proportions ($\sum W_{Di} / W_T$) of water supply delivered to each Republic adds up to 100%, the costs associated with managing the water released to Arnasai and the Aral Sea are automatically allocated to the Republics in proportion to the water deliveries to each Republic.

4.3 *HYPOTHETICAL APPLICATION*

Before addressing the more complex specific example applications, a hypothetical general application of the UoF method is presented. Figure 1 presents a schematic of a hypothetical river system and irrigation service areas that contains interstate water facilities. The schematic depicts a reservoir in Republic A that serves two areas in

Republic A by way of diversion structures and canals and delivers water to Republic B. All of the water delivered to Republic B is considered to be dependent on the interstate facilities.

The UoF method of cost allocation can be applied to this example for illustrative purposes. This example has all of the data needed to identify the degree to which each hypothetical republic utilizes the interstate facilities.

The particular criterion for determining the use of facilities, in this case, is water delivery. The degree or proportion of the water supply received by Republic B can be determined by tracing the water from the point of delivery to Republic B back to the original source, which is presumed to be the reservoir.

The annual average volume of water received by Republic B is 30,008 units at the point of delivery to Republic B. Since Reach C has a delivery efficiency of 95%, there must be 31,587 units of water at Diversion B that is committed to Republic B. Since Reach B has a delivery efficiency of 95%, there must be 33,250 units of water at Diversion A that is committed to Republic B. Continuing that process, since Reach A has a delivery efficiency of 95%, there must be 35,000 units of water at the reservoir that is committed to Republic B. Since the reservoir has an annual average yield of 100,000 units of water Republic B's use of the reservoir amounts to 35%, leaving 65% allocated to Republic A.

The last point of delivery of water to Republic A is at Diversion B which delivers 31,587 units of water to the canal supplying Service Area #2. In order to do that, since Reach B has a delivery efficiency of 95%, there must be 33,250 units of water at Diversion A that is committed to Republic A plus the 28,500 units of water that is diverted to Service Area #1. Therefore, at Diversion A there would be 61,750 units of water that is committed to Republic A. Continuing on to the reservoir, since Reach A has a delivery efficiency of 95%, there must be 65,000 units of water coming from the reservoir that are committed to Republic A.

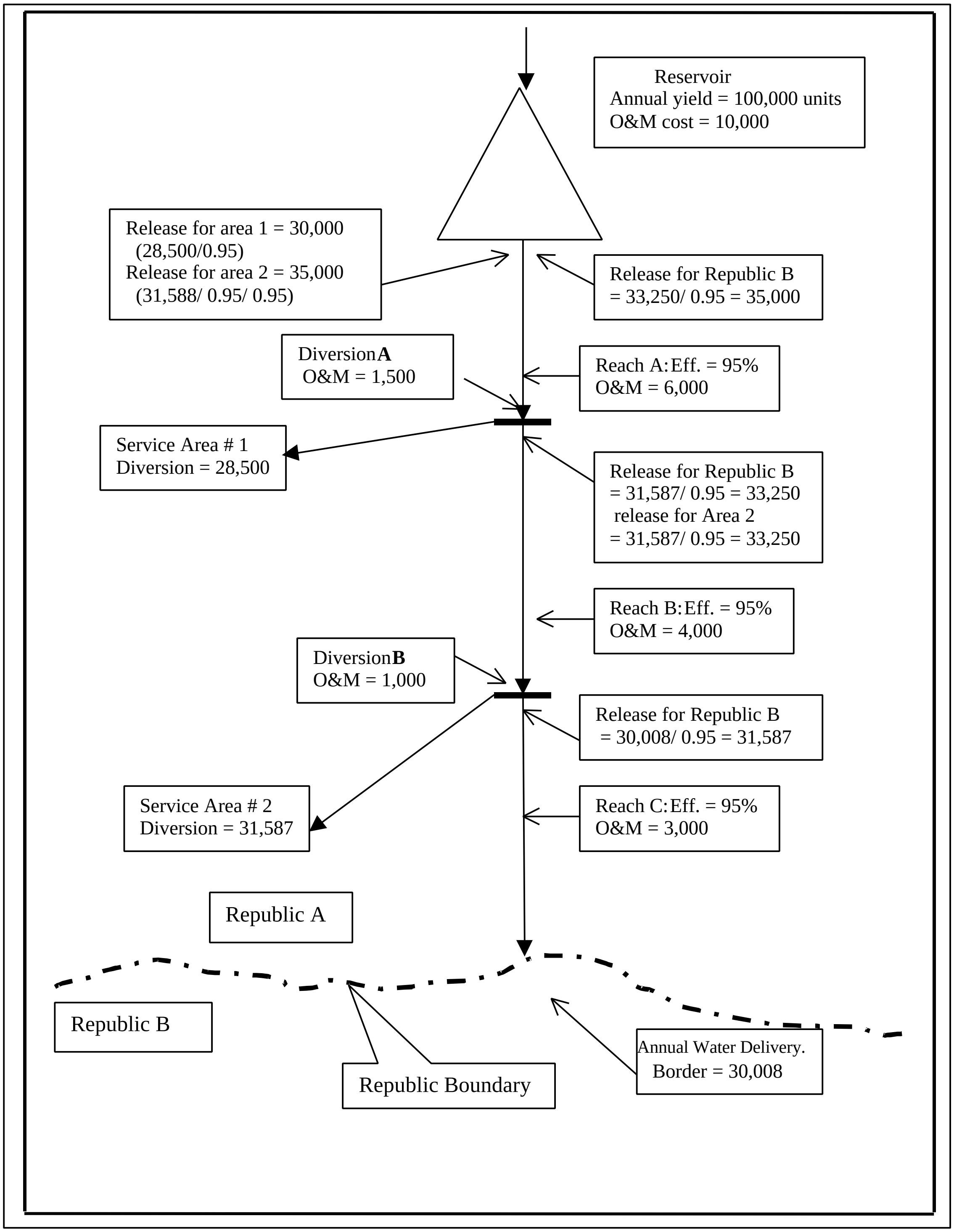

Figure 1: Schematic of Hydropothetical irrigation System

Table 1 illustrates how the O&M costs would be allocated to the Republics using the UoF Method. Starting at the point of delivery to Republic B and progressing back upstream, 100% of the water in Reach C is delivered to Republic B; therefore, 100% of the O&M cost of Reach C (3,000) is allocated to Republic B. Diversion B exists only for the purpose of diverting water to Service Area #2 in Republic A; therefore, 100% of the O&M cost of Diversion B (1,000) is allocated to Republic A. Since Reach B carries an equal amount of water for each Republic (31,587 units), the O&M cost for Reach B (4,000) is divided equally between the Republics (2,000 to each). Diversion A exists only for the purpose of diverting water to Service Area #1 in Republic A. Therefore, all of the cost of Diversion A (1,500) is allocated to Republic A. Reach A carries all of the water releases from the reservoir which amounts to 100,000 units, 65% of which are committed to Republic A and 35% to Republic B. The O&M costs of Reach A are allocated accordingly (65% to Republic A and 39% to Republic B). The O&M cost of the reservoir is allocated in the same proportion as the total water supply, 65% to Republic A and 35% to Republic B.

Table 1: Example Allocation of O&M Costs of Interstate Reservoir and Delivery System (Chart #1)

Facilities	O&M Cost	Proportionate Use		Allocated Cost	
		Republic A	Republic B	Republic A	Republic B
Reservoir	10,000	0.65	0.35	6,500	3,500
Reach A	6,000	0.65	0.35	3,900	2,100
Diversion A	1,000	1.00	0	1,000	0
Reach B	4,000	0.50	0.50	2,000	2,000
Diversion B	1,000	1.00	0	1,000	0
Reach C	3,000	0	1.00	0	3,000
Total	25,000			14,400	10,600

The reader should be aware that this hypothetical example is an over-simplification in that the transboundary facilities are clearly identified, O&M costs of those facilities are known, all needed water distribution data are clearly identified, service areas are known, and conveyance efficiencies are known. That is not normally the case in specific real applications which can be vastly more complex.

5.0 SPECIFIC EXAMPLE APPLICATIONS

It should be recognized that the participants in allocating costs of transboundary facilities are sovereign entities with their own national agendas. Therefore, the results are not only dependent on sound engineering and financial data, but also are the products of negotiations between those sovereign entities. Realistically, it is not likely that there is any allocation solution that will satisfy every aspect of each of those separate national agendas. The primary criterion of a successful allocation with such varied objectives by the participants is whether the results are acceptable by each party involved. Reaching agreement implies that each party is willing to give up something in order to reach the agreement. A general rule-of-thumb is that if agreement is reached and no party is fully satisfied with the result, it is probably a reasonably fair allocation

5.1 Identification of Transboundary Facilities and Associated O&M Costs

There are two essential bodies of information that must be developed in order to allocate the O&M costs of transboundary facilities to the interstate parties. First, the transboundary facilities must be identified which includes tracking the water from the facilities to the interstate parties receiving the water. Second, the O&M costs of those facilities must be accurately revealed. There are four tasks listed below that, if carefully performed, will provide the needed information. The first three tasks determine the facilities involved and the proportionate share of water provided. In other words, they provide the basis for making the allocation. The fourth task identifies the costs to be allocated.

- The first task in allocating O&M costs of transboundary facilities is for the parties involved to reach agreement on the identification of those facilities that do, in fact, provide interstate water. This requires participation by technical specialists representing each sovereign party. There must be an ability to track water from the facility to the receiving interstate parties.
- The second task is to agree on what parameters will be used to measure the proportionate use of the transboundary facilities by each party. Annual volume of water received by each party is usually the preferred parameter. However, water releases, proportionate assignment of storage and canal capacities, and extent of service areas are sometimes resorted to as allocation parameters.
- The third task is to agree on the data that will be used to measure the parameters. As with the costs, this requires participation of specialists from each party and a transparent policy with respect to sources and verification of data by each of the parties providing the data.
- The fourth task is to agree on the costs associated with those facilities that are to be allocated. It is critical that only the costs that are necessary for providing the interstate water be included in the allocation. This requires a transparent policy by the republic that owns the facility in question with respect to financial accounting records in order to gain the confidence and participation of the other parties.

The water and energy organizations of Kazakhstan, Kyrgyzstan, and Tajikistan provided the following specialists to work in collaboration with the EPIC Program consultant in obtaining the needed water delivery and O&M cost data for developing the example allocations:[8]

[8] Letter from Daene McKinney, Team Leader, EPIC Program, to Basarbai Mambetov, Deputy Chairman, Executive Committee of the Interstate Council for the Central Asian Economic Cummunity, October, 1999.

- Izbasar Satybaldiyev, Chief Engineer, Kurdai UVS, Zhambyl OblVodKhoz, Committee on Water Resources, Ministry of Agriculture, Republic of Kazakhstan;
- Esen Zhusumatov, Head, Administration for Operation of Irrigation Systems and Facilities, Department of Water Economy, Ministry of Agriculture, Kyrgyz Republic;
- Alexei Zyryanov, Head, Hydrotechnical Service, JSC KyrgyzEnergo;
- Nadezhda Leonidova, Head, Hydrotechnical Department, TajikHydroEnergyProject Institute.

As discussed in Section 1.0, four examples were selected for the purpose of illustrating the UoF methods of allocating O&M costs of transboundary facilities. These examples include:

- West Big Chu Canal, in the Kyrgyz Republic, a component of the Chu River system serving the Kyrgyz Republic and Kazakhstan;
- Chon Kakpah Reservoir on the Talas River in the Kyrgyz Republic, serving the Kyrgyz Republic and Kazakhstan;
- Toktogul Reservoir and the associated Uch-Kurgan re-regulation reservoir in the Kyrgyz Republic, a multiyear water supply and hydroelectric generating facility serving the Kyrgyz Republic, Tadjikistan, Uzbekistan, and Kazakhstan; and
- Kairakum Reservoir in Tadjikistan, a transboundary seasonal re-regulation water supply and hydroelectric generating facility serving Tadjikistan, Uzbekistan, and Kazakhstan.

Each of these examples is discusses in detail in the following section.

5.2 *THE CHU RIVER SYSTEM*

The Chu River System is very complex.[9] There are several side tributaries entering the river and several diversions from the river. There are numerous points of return flow from irrigation service areas. A simplified schematic of the Chu River System is presented in Figure 2. Major components serving both republics are shown.

5.2.1 Identification of Interstate Facilities

There was a late request to expand the allocation beyond just the West Big Chu Canal (WBCC) to include the entire Chu River irrigation system. Even though that was considered to be beyond the scope of the consultant's assignment, it was decided to include as much as could be expeditiously handled. That required assessing each of the major facilities to determine what facilities, in addition to WBCC, could be included.

Those include the Orto Tokoi Reservoir, the Bypass Canal that goes around a portion of the Chu River channel and reportedly incurs losses of approximately 30% of the flow in the river, the diversion to the WBCC, the Merken Branch delivery point at which water is delivered to Kazakhstan at the end of the WBCC, the Chumish Diversion on the Chu mainstem that diverts water to the Georgievsky Canal in Kazakhstan. Facilities were assessed starting with Orto Tokai Reservoir in the headwaters and progressing downstream.

5.2.1.1 Orto Tokai Reservoir

It was generally agreed that the Orto Tokai Reservoir, lying in the upper reaches of the Chu River Basin in the Kyrgyz Republic, provides seasonal storage for waters that are delivered to both the Kyrgyz Republic and to Kazakhstan. The only water release data provided for Orto Tokai Reservoir was the annual average flow for the years 1963-1987 which was reported to be 30.2 m^3/sec (952 million cubic meters per year).[10]

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[9] Be aware that the information presented in this section came primarily from translations of various Russian language documents. As a result, many of the names are spelled differently in different translations. Orto –Tokoy may be spelled Orto Tokai or Orto-Tokoi. Chumish is also spelled as Chumysh. Other terms may also have multiple spellings. Since the consultant had no way of knowing which were most appropriate, spellings are presented as translated in each supporting document.

[10] See "Chu River: Brief Hydrological Note" in Appendix A.

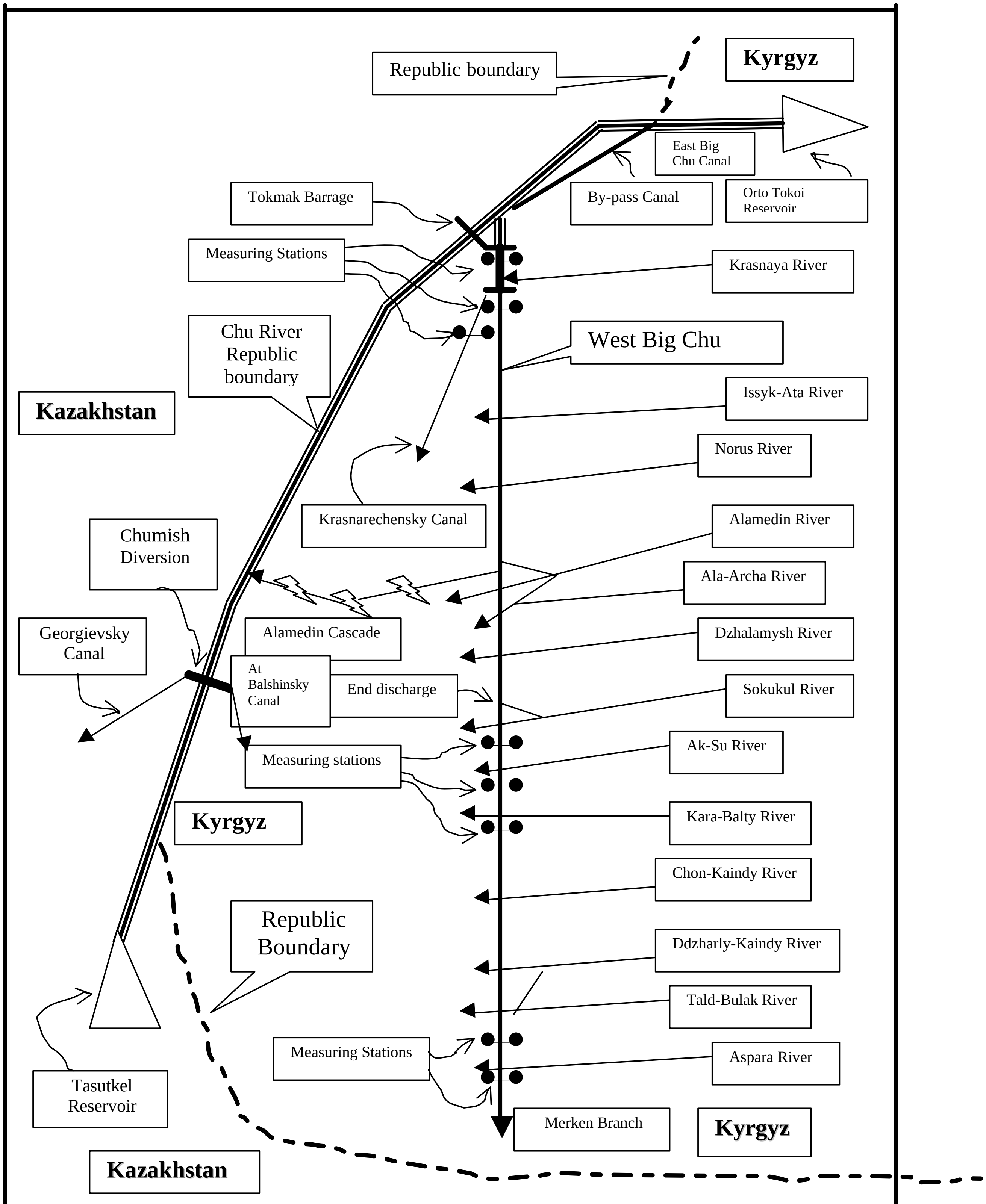

Figure 2: Simplified Chu River System Schematic

5.2.1.2 Chu Bypass Canal

It was presumed that the Bypass Canal provides interstate water since it is a lined canal that bypasses a reach of the Chu River channel that reportedly has losses of approximately 30%. Therefore, the Bypass Canal significantly enhances the available water supply by reducing seepage losses, at least in the immediate vicinity. However, how much of those seepage losses would have re-entered the surface flow downstream or entered an aquifer accessible to both republics was not addressed.

5.2.1.3 East Big Chu Canal

It was not clear that the East Big Chu Canal (EBCC) provides transboundary services even though there is some water that indirectly enters the WBCC from the EBCC.[11] Since any water entering the WBCC from the EBCC just replaces water that could have come directly from the Chu River into the WBCC, the EBCC was not considered to be an interstate facility.

5.2.1.4 Side Tributaries

There are several side tributaries entering from the Kyrgyz Republic that were not considered to be transboundary sources even though some water from them enter the WBCC and ultimately is delivered to Kazakhstan. The side tributaries are not considered to be transboundary in nature and as such the Kyrgyz Republic has the right to completely utilize those waters.[12] Therefore, any sidestream water entering Kazakhstan through the WBCC does so as a substitute for water that would have had to come from Orto Tokai Reservoir if the Kyrgyz Republic had fully utilized the flows from the side tributaries. Therefore, all of the water entering Kazakhstan through the WBCC, in effect, was credited to the WBCC and Orto Tokai Reservoir.

5.2.1.5 Chumish Diversion

The Chumish water control structure diverts water from the mainstem of the Chu River to the Kyrgyz Republic through the Atbashy Canal and to Kazakhstan through the Georgievsky Canal. Therefore, it was considered to be an interstate facility.

5.2.1.6 Downstream from the Chapaev Hydropost

None of the service area downstream from the Chapaev hydropost on the mainstem of the Chu River was considered to be served by interstate facilities since the Tasotkel Reservoir on the mainstem in Kazakhstan is large enough (620 million m3) to serve those areas even if Orto-Tokoi Reservoir did not exist.

From a strictly physical viewpoint, it appears that Orto-Tokoi Reservoir, the By-pass Canal, WBCC, and Chumish Diversion could be considered interstate facilities. However, in order to make an allocation of costs, the costs for each facility must be known. A review of the cost data in the following section reveals that costs are not

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[11] See Table A15 in Appendix A.

[12] This premise has historical support. See article 4 in "PROVISIONS of the Flow Allocation in the Chu River Basin …", in Appendix E.

specific to each of these facilities. O&M costs are separately identified for only Orto-Tokoi Reservoir and the Chumish Diversion (Water Control Structure). Costs for all other facilities are lumped together under the category of “Rivers and Canals Administration”.

5.2.3 O&M Cost Data

O&M cost data were provided for Orto-Tokoi Reservoir, the Chumysh Control Structure, and the Chu Rivers and Canals Administration. It is not certain that the costs for each of these facilities are mutually exclusive. Neverthelss, it was assumed, for this example allocation, that there are no costs associated with Ort-Tokoi Reservoir and Chumish that are also included in the Rivers and Canals Administration costs. In other words, it was assumed that the Chu Rivers and Canals Administration O&M costs represent all O&M costs incurred in the Kyrgyz Republic portion of the Chu River Valley except those for Orto-Tokoi Reservoir and the Chumish Diversion. The cost data on which the example allocations are based are summarized in Table 2. Costs of major repairs were not included in the example allocations.

5.2.4 Water Withdrawal Data

Since the water entering Kazakhstan through the Merken Branch at the tail end of the WBCC and that entering the Georgievsky Canal are the only waters considered to be dependent on interstate facilities for the purposes of this example, only water deliveries that are necessary to isolate the interstate facilities providing those waters are needed. The pertinent water delivery data are summarized in Tables 3 through 9. Table 3 presents water withdrawals from the Chu River for Kazakhstan at the Chumysh Diversion (Georgievsky Main Canal) and the Merken Branch, WBCC. It should be noted that Table 4 also presents water deliveries to Kazakhstan through the WBCC and the values are somewhat different from those presented in Table 3. The example allocation for the WBCC is based on the data in Table 4.

Table 2: O&M Costs of the Interstate Facilities to be Allocated

Facility	Cost (1000 soms)	Cost (US $1000)
Orto-Tokoi Reservoir[1]		
Operation and maintenance	2,191	46.91
Major repairs	3,849	82.41
Subtotal	6,040	129.32
Chumysh Control Structure[2]		
Operation and maintenance	2,584	55.33
Major repairs	1,992	42.65
Subtotal	4,576	97.98
Chu Rivers and Canals Administration[3]		
Operation and maintenance	15,943	341.39
Major repairs	16,900	361.88
Subtotal	32,843	703.27
All Interstate Facilities (Assumed for this example)		
Operation and maintenance	21,718	465.05
Major repairs	22,741	486.96
Total	44,459	952.01

(1) From Table A5, Apppendix A. (2) From Table A4, Appendix A
(3) From Table A1, Appendix A.

Table 3: Water Withdrawals from the Chu River to Kazakhstan[1]

Delivery Point	Annual total (rounded to nearest million m^3)		
	1996	1997	1998[2]
Chumysh Diversion	241	273	196
Merken Branch, WBCC	47	44	11
Total	288	317	207

(1) Source: Table A9 in Appendix A
(2) One source indicated that water deliveries were reduced in 1998 because of the lack of water service payments. No attempt to verify that was made.

Table 4: Water Delivery to Kazakhstan through the Merken Branch West Big Chu Canal

Year	Total Volume (million m^3)
1995	38.5
1996	53.8
1997	66.5
1998	42.3
1999	32.4
Average Annual	46.7

(1) Source: Table A19 in Appendix A

The diversion structure (referred to here as the Tokmak Barrage) diverts water to the WBCC, and it serves both the Kyrgyz Republic and Kazakhstan. This structure also diverts water to the Krasnorechinskiy Canal, which serves only the Kyrgyz Republic. Those data are presented in Tables 5 and 6. Both sets of data would be required to allocate the cost of the diversion structure; however, the O&M costs for that structure have not been separately identified. Therefore, the costs allocation for the WBCC is in two parts. The first allocates the O&M costs of the Rivers and Canals Administration between the WBCC and the rest of the Rivers and Canals Administration. That cost allocated to the WBCC was then suballocated between Kazakhstan and the Kyrgyz Republic based on the proportion of the withdrawals delivered to Kazakhstan at the Merken Branch and the total withdrawal by the WBCC.

Table 5: Water Delivery from the West Big Chu Canal to the Krasnorechinskiy Canal

Year	Total Volume (million m^3)
1995	1.739
1996	1.956
1997	2.503
1998	2.880
1999	2.304
Average Annual	2.276

(1) Source: Table A22 in Appendix A. Note that units have been converted to million.m^3.

Table 6: Water Withdrawal from the Chu River through the West Big Chu Canal

Year	Total Volume (million m^3)
1995	1038.5
1996	1054.0
1997	1082.6
1998	1087.1
1999	918.5
Average Annual	1036.14

(1) Source: Table A16 in Appendix A

The data in Tables 7 and 8 could be used to allocate the costs of the Chu Bypass Canal if the costs for that canal were separately identified.

Table 7: Feeding of the West Big Chu Canal from the Bypass Chu Canal

Year	Total Volume (million m^3)
1995	341.3
1996	320.9
1997	291.0
1998	226.0
1999	291.9
Average Annual	294.2

(1) Source: Table A14 in Appendix A

Table 8: Water Delivery to Kazakhstan through the Bypass Chu Canal

Year	Total Volume (million m^3)
1995	57.1
1996	62.0
1997	47.5
1998	46.1
1999	38.6
Average Annual	50.3

(1) Source: Table A12 in Appendix A

Table 9 presents the water diversions at the Chumysh Diversion. The waters diverted into the Georgievsky Canal go to Kazakhstan and the water diverted into the At-

Bashinsky Canal are used in the Kyrgyz Republic. The O&M costs for the Chumysh Diversion facility were allocated in proportion to those deliveries

Table 9: Water Diversions at the Chumysh Diversion

Year	At Bashinsky Canal[1] Total Volume (million m^3)	Georgievsky Canal[2] Total Volume (million m^3)
1995	128.7	221
1996	131.2	200.9
1997	126.3	209.1
1998	131.7	200.2
1999	136.5	221.5
Average Annual	130.9	210.5

(1) Source: Table A20 in Appendix A
(2) Source: Table A17 in Appendix A

The primary sources of water for the WBCC are the Chu and Krasnaya Rivers. Data in Tables 10, 11, and 12 are used to derive the water withdrawals by the WBCC. Table 10 shows water deliveries from the Chu River to the WBCC. Table 11 shows water deliveries from the Krasnaya River to the WBCC. Table 12 presents total water deliveries to the WBCC. It should be noted that the data in tables 10 and 12 are considerably different than the data in Table 6, which also is identified as water withdrawals from the Chu River to the WBCC. The example allocation is based on the data in Table 12.

Table 10: Water Delivery from the Chu River to the West Big Chu Canal

Year	Total Volume (million m^3)
1995	115.7
1996	109.6
1997	99.5
1998	80.7
1999	98.9
Average Annual	100.9

(1) Source: Table A23 in Appendix A. Note units converted to mln .m^3. and rounded.

Table 11: Water Withddrawals from Krasnaya River to the West Chu Canal

Year	Total Volume (million m^3)
1995	244.3
1996	255.9
1997	277.5
1998	303.1
1999	219.5
Average Annual	260.1

(1) Source: Table A24 in Appendix A. Note units converted to mln..m^3. and rounded.

Table12: Total Water Withdrawals to the West Big Chu Canal through Number 9 Measuring Station

Year	Total Volume (million m^3)
1995	360.0
1996	365.5
1997	402.6
1998	383.8
1999	318.4
Average Annual	366.1

(1) Source: Table A25 in Appendix A. Note units converted to mln .m^3. and rounded.

The water withdrawal data in Table 13 were used to make the initial allocation of Rivers and Canals Administration costs between WBCC and the rest of the Kyrgyz system which, for example allocation purposes, was represented by the EBCC withdrawals.

Table13: Water Withdrawal from the Chu River through the East Big Chu Canal

Year	Total Volume (million m^3)
1995	415.2
1996	404.0
1997	510.2
1998	465.7
1999	501.8
Average Annual	459.4

(1) Source: Table A13 in Appendix A.

5.2.5 Example Allocation of O&M Costs of Chu River Interstate Facilities

Figure 3, on the following page, is a simplified schematic that shows only the information needed in the cost allocation example. Note that all of the side tributaries except the Krasnaya River have been removed. Also, the many withdrawals along the WBCC that serve the Kyrgyz Republic, including waters diverted to the Alamedin Cascade have been removed. They are very important for conducting a thorough allocation of costs of the WBCC on a reach-by-reach basis.

However, since the amount of water diverted along the WBCC and the O&M costs of the diversion structures and canal reaches are not known, WBCC O&M costs can be only allocated on the proportions of water diverted into the WBCC at the headworks and the water entering Kazakhstan by way of the Merken Branch. All water entering the WBCC by way of diversions from the Chu and Krasnaya rivers, minus the water entering Kazakhstan at the Merken Branch were considered to be utilized within the Kyrgyz Republic.

Table 14: Example Allocation of O&M Costs for Chumysh Water Control Structure between Kazakhstan and the Kyrgyz Republic

Item	Water Withdrawals[1] (million m^3)			Allocation of O&M Costs (1,000 US $)		
	Kyrgyz (At-Bashinsky)	Kazakh (Georgievsky)	Total	Kyrgyz	Kazakh	Total[2]
Water withdrawal	131	210	341	---	---	---
Percent	38.4%	61.6%	100%	21.26	34.07	55.33

(1) Water withdrawal data from Table 9.
(2) Total cost data from Table 2.

Table 14 presents the example calculation of cost allocation for the Chumysh diversion between the Kyrgyz Republic and Kazakhstan based on the data presented above. Table 15 presented the allocation for the Rivers and Canal Administration O&M costs between the WBCC and the EBCC. Table 16 then reallocates the wBCC costs from Table 15 between the Kyrgyz Republic and Kazakhstan. Table 17 shows the example allocation of the Orto-Tokoi Reservoir O&M costs between the Republics. Table 18 summarizes and totals the information from the calculations in Tables 14-17.

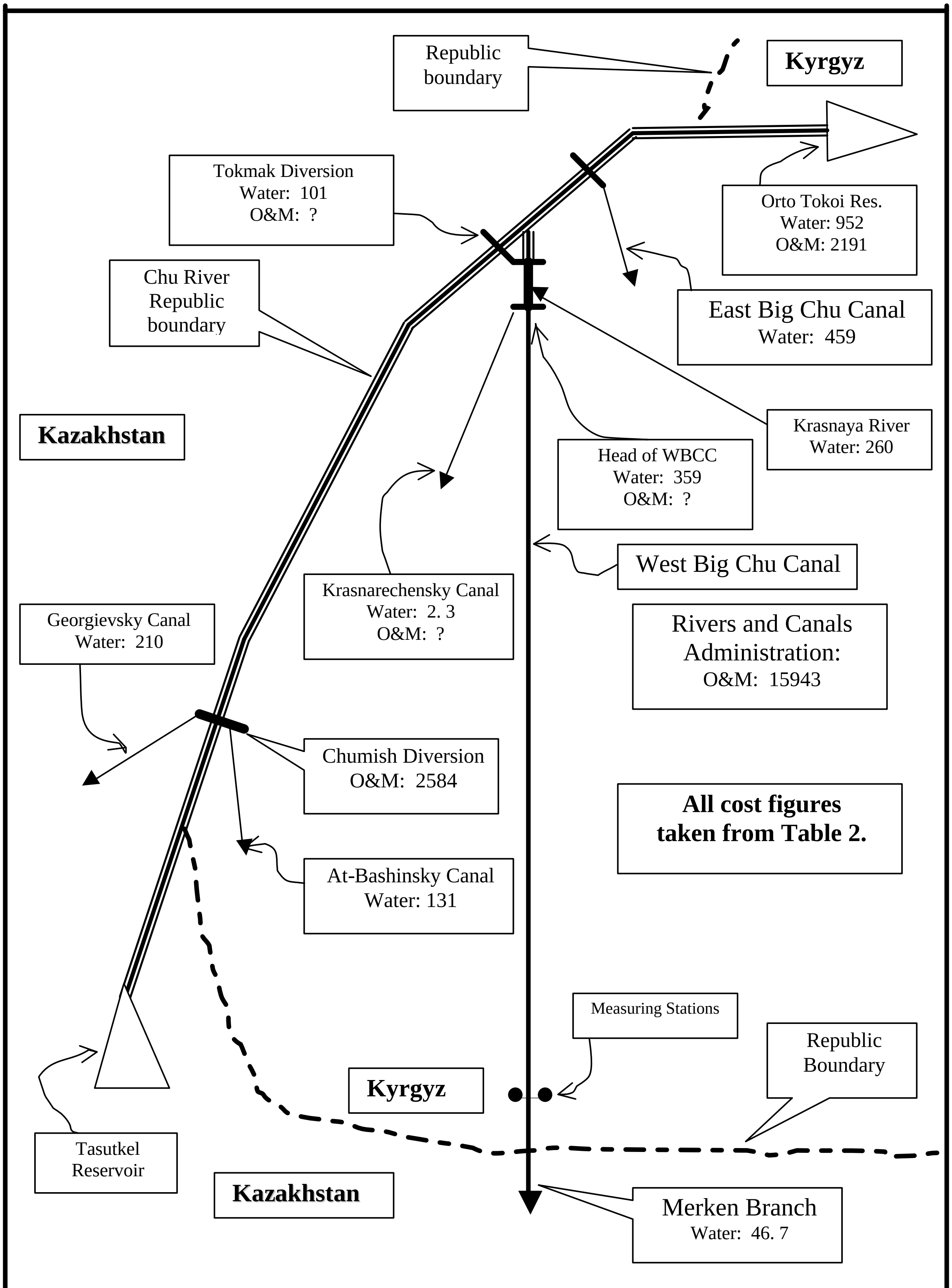

Figure 3: Simplified Chu River System Schematic for Allocation Purposes

Table 15: Example Allocation of O&M Costs for Rivers and Canals Administration between West Big Chu Canal and East Big Chu Canal

Item	Water Withdrawals (million m³)			Allocation of O&M Costs (1,000 US$)		
	WBCC	EBCC	Total	WBCC	EBCC	Total[3]
Water withdrawal	363.7[1]	459[2]	822.7	---	---	---
Percent	44.2%	55.8%	100%	150.9	190.5	341.4

(1) From Table 12 (WBCC) minus Table 5 (Krasnorechinsky Canal) .
(2) From from Table 13.
(3) Total cost data from Table 2.

Table 16: Example Re-allocation of O&M Costs Allocated to West Big Chu Canal between Kazakhstan and the Kyrgyz Republic

Item	Water Withdrawals (million m³)			Allocation of O&M Costs (US $)		
	Kyrgyz (Along WBCC)	Kazakh (Merken)	Total	Kyrgyz	Kazakh	Total[3]
Water withdrawal	317[1]	46.7[2]	363.7	---	---	---
Percent	87.2%	12.8%	100%	131.6	19.3	150.9

(1) Total 363.7 minus 46.7 (Merken Branch withdrawal) .
(2) From from Table 4.
(3) Total cost data from Table 15.

Table 17: Example Allocation of O&M Costs for Orto-Tokoi Reservoir

Item	Water Withdrawals (million m³)			Allocation of O&M Costs (US $)		
	Kyrgyz	Kazakh	Total	Kyrgyz	Kazakh	Total[1]
Georgievsky	---	131[1]		---	---	---
Merken	---	46.7[2]		---	---	---
Total	774.3[3]	177.7	952[4]	---	---	---
Percent	81.3	18.7	100	38.1	8.8	46.9

(1) From Table 9.
(2) From from Table 4.
(3) Total (952) minus Kazakh withdrawal (177.7).
(4) From narrative, p. 10, Identifying Interstate Facilities.
(5) From Table 2.

Table 18: Summary of Example Allocations of O&M Costs of Chu River Interstate Facilities

Interstate Facility	Allocation of O&M Costs (US $)		
	Total	Kazakhstan	Kyrgyz Republic
Chumysh Diversion	55.3[1]	34[2]	21.3[2]
EBCC	190.5	-0-	190.5
WBCC	150.9[3]	19.3[4]	131.6[4]
Orto-Tokoi Reservoir	46.9[1]	8.8[5]	38.1[5]
Total	443.6[1]	62.1	381.5

(1) From Table 2.
(2) From Table 14.
(3) From Table 15.
(4) From Table 16.
(5) From Table 17.

The reader should keep in mind that this is an example allocation developed for the purpose of illustrating the application of the Use-of-Facilities method of cost allocation. The results are not to be viewed as a basis for actual obligatory allocations for the following reasons:

- Water delivery data were not provided for points that would have allowed allocations on a reach-by-reach basis;
- Costs were not broken down for each interstate water control facility nor for each reach of interstate canals;
- Withdrawals serving Kazakhstan directly from the Chu River above the Chumysh Diversion were not included.

Therefore, the specific results should be viewed with caution since the identification of the interstate facilities, the tracking of water deliveries, and the facility-specific costs all warrant closer study by specialists from both republics.

5.3 *TALAS RIVER SYSTEM*

The Talas River has its origins in the Talas and Kyrgyz mountain ranges, flows generally westward through and extensive irrigated area in the Kyrgyz Republic then it enters the Kirovsk Reservoir (also known as Kirovskoye Reservoir and Chon Kapkin Reservoir) near the village of Kirovka. It serves a smaller irrigated area in the Kyrgyz Republic below Kirovsk Reservoir, which was constructed in 1974, then turns generally south and enters Kazakhstan. Figure 4 presents a simple schematic of the system beginning with Kirovsk Reservoir and proceeding downstream to the Temirek Reservoir in Kazakhstan.

5.3.1 Identification of Interstate Facilities

The Kirovsk Reservoir serves areas in the Kyrgyz Republic and in Kazakhstan. Therefore, the reservoir and the Head Regulator, which is considered an integral part, are considered to be interstate facilities that warrant O&M cost sharing between the republics.

The Kyrgyz areas are served from diversions between the reservoir and the Pokrovka measuring station just upstream from the republic boundary. Diversion points include the Bala-Sary Canal, Kadyr-Ali Canal, Baisu Canal, Saza Canal, and Urt Canal. These canals and the associated diversion structures serve only the Kyrgyz Republic. Therefore, they are not considered to be interstate facilities.

5.3.2 O&M Costs of the Interstate Facilities

Kirovsk Reservoir, including the Head Regulator, is considered to be the only interstate facility in the Talas River system. The annual operating and maintenance costs in 1998 were reported to be US $ 185,338.3. That is the amount on which this example interstate cost-sharing allocation is based. The proportionate water withdrawals going to the Kyrgyz Republic and to Kazakhstan that are credited to the interstate facilities determine how those costs could be shared.

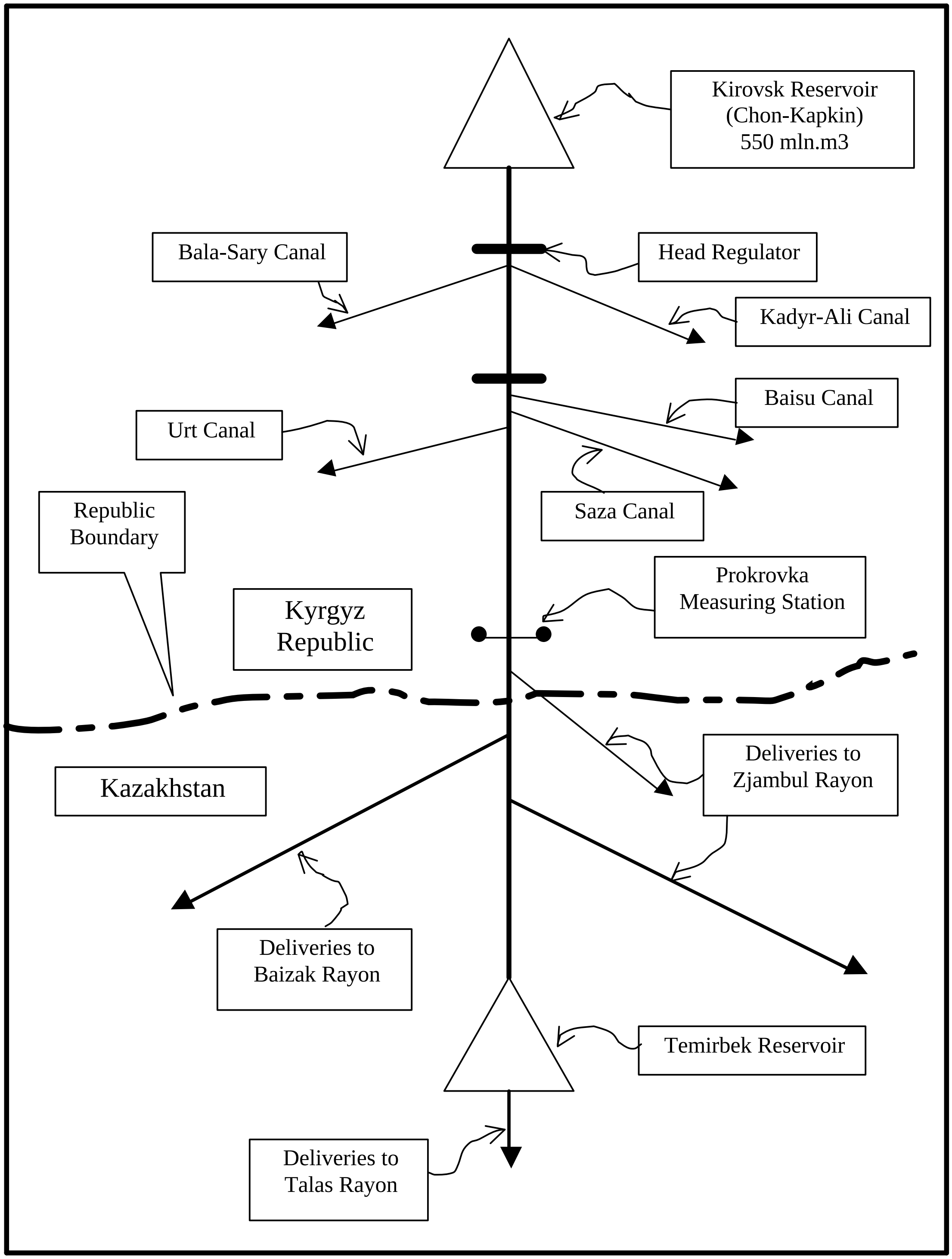

Figure 4: Simplified Schematic of Talas River System

5.3.3 Water Withdrawals

The areas in Kazakhstan that depend on water from Kirovsk Reservoir, primarily Zjambul and Baizak rayons, are served from diversions between Pokrovka measuring station on the Talas River just upstream of the republic boundary and the Temirbek Reservoir in Kazakhstan. Temirbek Reservoir is large enough to adequately serve all of the lands below it, primarily Talas Rayon, even if Kirovsk Reservoir did not exist. Therefore, only water withdrawals to serve Zjambul and Baizak rayons were used as a basis for determining O&M cost sharing for the interstate facilities.

Table 19 presents the total water withdrawal from the Kirovsk Reservoir during the years 1995 –1998. Tables 20 and 21 present the withdrawals from the Talas River for the Kyrgyz Republic and Kazakhstan respectively. Since all withdrawals from the Kirovsk Reservoir must end up in either the Kyrgyz Republic or Kazakhstan, the summation of the withdrawals in tables 20 and 21 should be close to the withdrawals in Table 19, with some adjustment for losses. However, considering losses, one would expect the sums of the withdrawals to serve the Kyrgyz Republic and Kazakhstan to be less that the total releases from Kirovsk Reservoir. That is not the case.

For each year, there is more water withdrawn from the Talas River below Kirovsk Reservoir than is released from the reservoir. That could only happen if there are tributaries entering the Talas River below Kirovsk and/or return flows into the river. One other possibility is that there are unexplained inconsistencies in the data. Table 22 presents total withdrawals from the Kirovsk Reservoir for each republic that are somewhat different than the data presented in tables 20 and 21.

Table 19: Water Withdrawal from the Kirovsk (Chon-Kapkin) Reservoir

Year	Total Volume (million m^3)
1995	802
1996	692
1997	725
1998	891
1999	not available
Average Annual	778[2]

(1) Source: Table B1 in Appendix B
(2) Average for years 1995-98.

Table 20: Water Withdrawal from the Talas River for the Kyrgyz Republic[1]

Year	Total Volume[2] (million m^3)
1995	167.8
1996	201.9
1997	183.6
1998	276.6
1999	not available
Average Annual	207.5[3]

(1) Source: Table B2 in Appendix B

(2) It was understood that these withdrawals took place below the Kirovsk (Chon-Kapkin) Reservoir, but that was not verified.

(3) Average for years 1995-98.

Table 21: Water Withdrawal from the Kirovsk (Chon-Kapkin) Reservoir for Delivery to Kazakhstan

Year	Total Volume (million m^3)
1995	734.2
1996	727.3
1997	645.0
1998	658.4
1999	not available
Average Annual	691.2[2]

(1) Source: Table B3 in Appendix B

(2) Average for years 1995-98.

Table 22: Water Withdrawal from the Kirovsk (Chon-Kapkin) Reservoir for delivery to Kyrgyzstan and Kazakhstan

Year	Volume Withdrawn (million m^3)		
	Kyrgyzstan	Kazakhstan	Total
1995	153	804	957
1996	241	644	885
1997	179	554	733
1998	231	740	971
1999	144[2]	716[2]	860
Average Annual[2]	201	686	887

(1) Source: Table B7 in Appendix B

(2) 1999 totals do not include deliveries for the months of November and December; therefore 1999 was not used in calculating the averages.

All water in the Talas River water below the Pokrovka measuring station goes to Kazakhstan. Table 23 presents those measurements. Without Kirovsk Reservoir that water would enter Kazakhstan in an unregulated pattern. So the benefit that Kirovsk Reservoir provides to Kazakhstan is regulation of water releases. However, Kazakhstan does not need the regulation provided by Kirovsk Reservoir for all of its service areas. As was stated before, Temirbek Reservoir in Kazakhstan provides storage and flow regulation for the service area in Talas Rayon.

Table 23: Water Consumption at Pokrovka Measuring Station[1,2]

Year	Total Volume (million m^3)
1995	828.4
1996	641.0
1997	538.2
1998	722.4
1999	not available
Average Annual	682.5[3]

(1) Source: Table B8 in Appendix B
(2) The translation "consumption" is assumed to mean "measurement". Note: all flow measured at Pokrovka measuring station ultimately goes to Kazakhstan.
(3) Average for years 1995-98. Note: Due to lack of financial resources in Zhambylvodhoz to pay Kazgidromet for its services, the latter has not provided information since December 1998.

Table 24 presents water measurements at measuring stations along the Talas River for years 1966-1976. Even though the time frames represented in Tables 22 and 24 are quite different, annual average measurement at Pokrovka measuring station are reasonably close. The data in Table 24 shows that most of the water released from Temirbek Reservoir, which serves the Talas Rayon, occurs in the non-growing season which

Table 24: Register of Average Multi-Year Water Consumption at Measuring Stations along the Talas River, 1966-76 (million m3)

Stations	Growing Season	Non-growing Season	Annual Total
Kirovsky	641.4	388.9	1030.0
Pokrovka (1970-75)	356.9	355.4	712.3
Temirbek Discharge	138.9	401.6	540.5
Withdrawal at Temirbek Structure	19.4	2.0	16.41
Total for Temirbek Structure	153.38	403.6	556.98

Source: Table B4 in Appendix B.

indicates that these are likely releases that are not dependent on regulation and, therefore, not creditable to either Temirbek or Kirovsk reservoirs. The relatively small withdrawals during the growing season indicate that Temirbek Reservoir likely meets that regulation need.

One could argue that the data in Table 24 for Temirbek occurred before Kirovsk Reservoir was completed and, therefore, does not represent recent demands during the growing season. However, the data in Table 25, which represents 1995 and 1996 conditions, shows even less water being released now from Temirbek for irrigation than occurred before Kirovsk Reservoir was completed. So it was assumed that Temirbek Reservoir does, in fact, provide all of the regulation necessary to meet the irrigation needs in Talas Rayon. On that basis, it could be argued that none of the releases below Temirbek Reservoir should be credited to Kirovsk Reservoir storage. It could also be argued that a good share, if not all, of the water available at Temirbek Reservoir results from return flows from the irrigated areas in Zhambul and Baizakskiy Rayons. Neither return flow data nor measuring station data were provided that could be used to determine a reasonably accurate representation of the actual situation.

Table 25: Water Withdrawal from the Talas River for Irrigation in Zhambul Oblast, Kazakhstan[1]

Year	Total Volume (million m^3)
Zhambul Rayon	
1996	34.7
1997	154.5
1998	126.0
Three year average	105.1
Baizakskiy Rayon	
1996	457.3
1997	395.8
1998	391.0
Three year average	414.7
Talas Rayon	
1995	27.4
1996	18.6
1997	not available
Two year average	23.0

(1) Source: Table B6 in Appendix B

5.3.4 Example Allocation of Talas River Interstate FacilitiesG

The example allocation was based on the assumption that waters received by Kazakhstan that are dependent on the regulation capabilities of Kirovsk Reservoir are delivered to Zhambul and Baizakskiy Rayons. Table 25 shows that during the three years of 1996-1998, the Zhambul and Baizakskiy Rayons received 105.1 and 414.7 million m3 respectively for a total annual average withdrawal of 519.8 million m3. During those same years, based on the data in Table 23, the Pokrovka measuring station indicated that the three-year annual average delivery to Kazakhstan was 633.9 million m3. That corresponds very closely with the annual average for the same three years that were released from Kirovsk Reservoir which, using the data in Table 22, amounts to 646.0 million m3 per year.

Under the assumption that non-irrigation withdrawals are not dependent on regulation by Kirovsk Reservoir, it was further assumed that the annual average withdrawal of 519.8 million m3 to serve irrigation in the Zhambul and Baizakskiy Rayons represents the total annual amount of water received by Kazakhstan that is dependent on regulation provided by Kirovsk Reservoir.

Table 26 presents the resulting example allocation of interstate facility O&M costs.

Table 26: Example Allocation O&M Costs of Talas River System Interstate Facilities

Item	Annual Average Withdrawal (million m^3)	Percent	O&M Cost (US $ 1,000)
Kirovsk Reservoir	863[1]	100.0	185.3
Kyrgyz withdrawal	217[1]		
Kazakh withdrawal (total)	646[1]		
Kazakh withdrawal dependent on interstate regulation	520[2]	60.3	111.8[3]

(1) Calculated using 1996-1998 data in Table 22.
(2) Calculated using 1996-1998 data in Table 25.
(3) Represents Kazakhstan's share of the interstate O&M costs (60.3% of 8,655.3 thousand soms)

5.4 *TOKTOGUL AND KAIRAKUM RESERVOIRS*

Toktogul water control structure has a hydropower station (HPS) with the capacity of 1,200 megawatts and a multi-year flow regulation reservoir with the active capacity of 14-billion m^3 and water surface of 284 km^2 . The reservoir was built for efficient and comprehensive use of water resources for the needs of the energy sector and irrigation. It has the following performance characteristics:

For irrigation:

- Guaranteed water supply for 800,000 ha of irrigated lands located in the Syr Darya basin;
- Water supply for additional 480 thousand hectares;
- Guaranteed water supply equal to 19.5 billion m^3 instead of the 15.0 billion m^3 of the central part of the Syr Darya basin on the area of 800 thousand hectares.

For energy:

- Guaranteed power capacity of the HPS equal to 260,000 kW;
- Power generation equal to 4,400 million kWh;
- Annual use of the installed capacity equal to 3,650 hours.

The design of Toktogul water control structure required 63% of the investments for irrigation, and 37% for energy production.

Beginning from 1995, the Agreement between the Governments of the Republic of Kazakhstan, the Kyrgyz Republic, and the Republic of Uzbekistan provided for the rational use of the Syr Darya basin water resources stored in Toktogul Reservoir for satisfying irrigation needs in summer period. During the last 5 years (1995-1999), Toktogul Reservoir has been used for annual regulation and water supply of neighboring republics.

Uch-Kurgan water control structure provides for daily regulation of water releases in accordance with the irrigation schedule. It has the following performance characteristics:

For irrigation:

- Actual capacity of the daily regulation reservoir is 16 million m^3 ;
- Two irrigation water outlets from the reservoir with water flow under “UMO BNK” equal to 61 m^3 /sec, and “LBK” – 18 m^3 /sec;
- Re-regulation and water supply of the lower reach of the HPS in accordance with the irrigation schedule;
- Additional irrigated lands equal to 45 thousand hectares.

For energy:

- Installed capacity of 180 thousand kW;

- Annual power generation of 820 thousand kWh.

The Kairakum Reservoir, consisting of the hydraulic power system and reservoir, is designed for seasonal regulation of the Syr Darya flow to satisfy the needs of the energy sector and irrigated cotton-growing areas of the Fergana Valley, Golodnaya and Dalverzinskaya steppes. Being the umbilical reservoir in the Syr Darya basin, the Kairakum Reservoir irrigates 270 thousand ha of the cotton-growing lands and 75 thousand ha of the Syr Darya lower reaches in the rice-growing regions of Central Asia.

5.4.1 Identification of Interstate Facilities

Toktogul and Uch-Kurgan reservoirs are treated as one in the example allocation. It could be argued that, since Uch-Kurgan mitigates the daily fluctuations structure in flow caused by Toktogul energy releases, it should be treated as a separable energy facility with all of its O&M costs being assigned to recovery through energy rates. However, it does provide some distribution of water for irrigation and is included in the example allocation as an integral component of Toktogul Reservoir for allocation purposes.

Toktogul and Kairakum reservoirs can not realistically be analyzed separately since they are so interdependent.[13] The operational mode of each reservoir is influenced by and influences the operational mode of the other. Therefore, Toktogul (including Uch-Kurgan) and Kairakum O&M costs have been allocated together.

5.4.2 O&M Cost Data

The O&M costs for Kairakum Reservoir are presented in Table 26. However, they are in Tajik rubles and no information was provided for converting to Kyrgyz som. Therefore, in order to complete the mechanics of the example allocation, it was arbitrarily assumed that the O&M cost for Kairakum Reservoir are one-half the cost for Toktogul.

Table 27 shows Toktogul O&M costs, including Uch-Kurgan, to be 94,400 som (US$ 2,021.4) (rounded) for 1998. Therefore, O&M cost for Kairakum for 1998 were arbitrarily assumed to be 47,200 som (US $ 1,010.7). Table C1, in Appendix C, which is the source for Table 27, appears to not have any separable hydropower facility costs included. For the example allocation, it was assumed that the cost data provided for Toktogul and Uch-Kurgan Reservoirs excluded any separable hydropower cost. Therefore, all of the O&M costs provided is allocatable to the respective republics.

[13] Ibid., Khamidov and Leshanskiy

Table 26: Total Annual O&M Costs of the Kairakum Water Structure
(Report for 1998)

Costs	Amount of Costs (Tajik rubles)	Amount of Costs (US $)
Major Wages of Production Workers	17,281,586	11,918.3
Social Insurance Deductions from Wages (25% + 1% pension fund)	598,807	412.9
Operation and Maintenance of Equipment	203,589,768	140,406.7
Departmental Overheads	19,186,566	13,232.1
Structure Overheads	206,261,921	142,249.6
Running Repairs	127,888,828	88,199.2
Major Repairs	78,373,093	54,050.4
Total	446,918,648	308,219.8

Source: Table D2 in Appendix D.

Table 27: Total Annual O&M costs of Interstate Facilities of Joint Use
(Report for 1998)

Interstate Facility	Costs[1] (1,000 som)	Costs (US $ 1,000)
Toktogul	78,341.0	1,677.5
Uch-Kurgan	13,056.9	279.6
Subtotal	91,397.9	1,957.1
Kairakum	47,200[2]	1,010.7
Total Costs (rounded)	138,600	2,967.9

(1) Source of Toktogul and Uch-Kurgan cost data is Table C1 in Appendix C.
(2) Kairakum cost was arbitrarily assumed to be one-half of Toktogul and Uch-Kurgan cost (rounded) for expediency due to lack of factors for converting Tajik rubles to Kyrgyz som.

5.4.3 Water Withdrawals

The UoF method of cost allocation is based on users sharing interstate costs in proportion to the amount of water they use. Therefore, the amount of water delivered to each republic must be identifiable. There is a considerable amount of water flow and withdrawal data for the interstate facilities in Appendixes C and D. However, there is little to no information that allows the water to be tracked to the republics that ultimately receive it. Therefore, as a matter of expediency, the example allocation was based on the historical shares of water deliveries received by each republic instead of on documented recent deliveries.

5.4.3 Example Allocation of Interstate Facilities

The O&M costs of the interstate facilities to be allocated amounted to 138,600 thousand Kyrgyz som (US$ 2,967.9) (Table 27). In thousands of som, that consists of 78,300 for Toktogul, 13,100 for Uch-Kurgan, and an arbitrarily determined 47,200 for Kairakum. The total cost is allocated to the republics according to historical percentage shares of the total water supply delivered to each republic. The example allocation is presented in Table 28.

Table 28: Allocation of Annual Water Supply O&M Costs to the Republics

Republics	Historical shares of Water Deliveries[1] (%)	Allocated Costs (1,000 som)	Allocated Costs (US $ 1,000)
Kyrgyz Republic	5.0	6,900	147.7
Tajikistan	7.5	10,400	222.7
Uzbekistan	57.3	79,400	1,700.2
Kazakhstan	30.2	41,900	897.2
Total	100.0	138,600	2,967.8

(1) Source: WARMAP Project: *Formation and Analysis of Regional Strategies of Land and Water Resources*, July 1997, (page 112, Table 10.2)

APPENDIX A: CHU RIVER SYSTEM DATA

The data provided for the Chu River system consists of a brief description of the hydrology of the Chu River, O&M cost data for the system, and water withdrawals.

Chu River: Brief Hydrological Note

Maximum water withdrawals are registered in the high water period, usually in middle June. The maximum average withdrawal ranges 120-125 m^3/s. The highest maximum urgent withdrawal observed in the period from 1931 to 1980 was 242 cu m/s (06.19.1966). The withdrawal estimated for 1932-1966 was ? m^3/s for the 1% availability, 216 m^3/s for the 2% availability, and 190 cu m/s for the 10% availability.

The Chu River is formed by the confluence of the Dzhuvanaryk and Kochkor rivers in the Kochkor depression within the Naryn oblast. On the east the Kochkor depression is closed by the offsets of the Kyrgyz Range and the Terskey-Alatau Range. The Chu valley dissects these mountains broadwise forming the Upper Orto Tokoi Gorge and the Lower Orto Tokoi Gorge. In 1959 the dam of Orto Tokoi Reservoir (W=470 million m^3) was constructed at the latter gorge. Downstream from the reservoir, the river flows through the Issyk Kul basin among powerful alluvial deposits. In the early 1950's, the Kumaldy branch of the river flowed toward the Issyk Kul lake. A part of the Chu flow was discharged to the Issyk Kul Lake through that branch in the years of high floods. The introduction of Orto Tokoi Reservoir resulted in the disconnection of the link between the Chu River and the lake.

The watershed area of the Chu River at the village of Kochkorka is 5,370 sq km. The average elevation of the watershed is 2,840 m^2. The Chu River at this location is fed by glaciers and snow. Major source of flow is snowmelt of seasonal and high-level snow, and glaciers. Average annual flow of the Chu River at Orto Tokoi Reservoir is 30.2 m^3/s or 952 million m^3 in volumetric terms (Data for 1963-1987). The coefficient of variation of annual flow is Cv – 0.18.

Chu River System O&M Cost Data

Table A1: Operational Costs Estimate of the Rivers and Canals Administration of the Chu Valley
Water Management Department, Kyrgyz Republic
1998

Levels of Economic Classes of State Costs	Costs	Annual Plan	Including			
			I	II	III	IV
10.1.1.2	Water Management Department					
1.1.0.1	Wages	9407	2351	2351	2351	2354
1.2.1.1	Social Fund Deductions	3434	858	858	858	860
1.3.1.1	Travel Expenses	300	75	75	75	75
1.3.2.1	Acquisition of Equipment, Stock and Materials	702	175	175	175	177
1.3.3.1	Water, Electricity, Gas, Telephone, Heating	700	175	175	175	175
1.3.3.3	Renting of Vehicles Maintaining of Own Vehicles	700	175	175	175	175
1.3.4.1	Other Acquisitions and Services	700	175	175	175	175
4.0.0.4	Major Repairs	16900	4225	4225	4225	4225
	Total	32843	8209	8209	8209	8216

I. I. Bashara

Table A2: Performance Report of the Operational Costs Estimate for Water Systems and Facilities 1998

Measures	Line No.	Amount of Work			Costs (roubles)				
		Units	Plan	Report	Plan		Report		
					Total	Wages	Estimate Cost	Actual Cost	Wages
1.Wages of Operations Personnel (Offices and Locations)	1	Persons	197		2976.5	2180.7			
Including Administrative and Management Personnel	2		17		314.4	230.4			
Business Trips	3	x	x	x	28	x			x
Stationery, Typography, Mail, Telegraph &Telephone	4	x	x	x	13	x			x
Other Administrative Exp.	5	x	x	x	211.9				
Total for Part 1	6	x	x	x	3229.4	2180.7			
2. Operational Costs and Running Repairs Maintenance and Repairs of Water Facilities	7	Pieces	595		1765.2	1058.7			
Running Repairs	8	Item	180		275.1	55			
Maintenance and Repairs of Measuring Stations	9	Item	369		367.7	202.2			
Running Repairs	10	Item	160		125.8	25			
Maintenance and Repairs of Civil and Industrial Buildings	11	Item	12		667	409.6			
Running Repairs	12	Item	10		100	25			
Maintenance and Repairs of Communication Equipment	13	Km	10		450	90			
Running Repairs	14	Item	10		450	90			
Maintenance and	15	x	x5	x	1628	325.6			

Measures	Line No.	Amount of Work			Costs (roubles)				
		Units	Plan	Report	Plan		Report		
					Total	Wages	Estimate Cost	Actual Cost	Wages
Repairs of Dikes and Canals									
Running Repairs	16	x	x5	x	1628	325.6			
Maintenance and Repairs of Operation Mechanisms	17		5		100	25			
Running Repairs	18		5		100	25			
Maintenance and Repairs of Pumping Stations, Lift Stations and Power Stations	19	Pieces							
Including a) Personnel	20								
b) Electric Power	21								
Maintenance and Repairs of Wells	22								
Vertical Drainage	23								
Maintenance and Repairs of Vehicles, total	24		20		3710.2	606.9			
a) Automobile Transportation	25	Pieces	20		3710.2	606.9			
Compensation of Motorcycle Expenses	26								
Table continued on next page									
b) Cartage (horses, bulls, asses)	27	Animal Unit							
Forage	28								
Cleaning of State (Interfarm) Irrigation and Drainage Systems a) Manual	29	1000 m^3							
Including Collector and Drainage Flow	30								
b) Mechanized	31	1000 m^3	154		2538.9	508			
Including Collector and Drainage Flow	32								
Protection and Regulation Work	33				200	40			

Measures	Line No.	Amount of Work			Costs (roubles)				
		Units	Plan	Report	Plan		Report		
					Total	Wages	Estimate Cost	Actual Cost	Wages
Including Automobile and Motorcycle Transportation									
Flood and Sludge Ice Protection Activities	34				1386.7	277			
Levelling of Dams, Canals, Installation of Reference Points	35				46	11			
	36				12659.5	3514			
Total for Part 2	37								
3. Other Costs Emergency Stock of Materials	38								
Forest Stands	39	Ha	123		54	13			
Bonuses	40								
Other Expenses	41								
Total for Part 3	42				54	13			
Total for Parts 1-3	43				15942.9	5707.7			
Labor Participation in the Repairs of State (Interfarm) Systems, Including Running Repairs	44				6904.3	1394.6			
Loans Movement Certificate	45								
Opened Credits	46								
Cash Disbursements	47								

End of Table A2: Performance Report of the Operational Cost Estimates for Water Systems and Facilities, 1998

Table A3: Performance Report of the Major Repair Costs Estimate for Fixed Assets of Water Systems and Facilities 1998

Measures	Line No.	Amount of Work			Costs (roubles)				
		Units	Plan	Report	Plan		Report		
					Total	Wages	Estimate Cost	Actual Cost	Wages
Repairs of Water Facilities	1		2		3000	600			
Repairs of Measuring Stations	2	Pieces							
Repairs of Civil and Industrial Buildings	3	Pieces /m3	1		1500	300			
Repairs of Communication Equipment	4	km			2000	300			
Repairs of Dikes and Canals	5	x	11		8380	2095			
Repairs of Operation Roads	6								
Repairs of Pumping Stations, Lift Stations and Power Stations	7	Pieces							
Repairs of Transportation	8	x	9		1200	240			
Repairs of Production Stock	9								
Repairs of Earthmoving Machines	10		4		820	164			
Total	11				16900	3699			
Noncontracted Method	12								
Bulk Work									
Noncontracted Method					32842.9	9406.7			
					23804.3	5093.6			
					15942.9	5707.7			

Head of Organization
Chief Accountant
October 10, 1997

Table A4: Calculation of the Funds Demand to Operate the Chumysh Water Control Structure

Measures	Units	Quantity	Sum, thousand som	Including Wages, thousand som
Management and Field Engineering Personnel	Persons	20	202	150
Maintenance				
Water Facilities	Item	20	315	87
Civil and Industrial Buildings	Item	5	50	30
Communication and Automatic Equipment	1000 som	2	100	15
Transportation and Linear Actuators	Pieces	4	50	16
Running Repairs				
Water Facilities	1000 som		209.3	66.9
Measuring Stations	Item		25.9	8.3
Civil and Industrial Buildings	Item		48.1	15.4
Communication and Automatic Equipment	Item		113.1	36.2
Canals	Item		51.6	16.5
Flood Protection	Item		1419.5	454.3
Total			2584.5	895.6
Major Repairs	1000 som		1992	637.4
1. Rehabilitation of a Measuring Station on the Chu River	Item		1061	339.5
2. Mechanized Cleaning of the Chu River Channel	Item		611	195.5
3. Major Repairs of Mechanisms	Item		320	102.4
Total			4576.5	1533

A. Isabekov
Chief of Chumysh Accounts Department,
Water Management Department

Approved by
P. M. Chernonozhkin,
Head of the Orto-Tokoi
Reservoir Administration

Table A5: Operational Costs Estimate of the Orto-Tokoi Reservoir Administration
Kyrgyz Republic
(State Budget for State Agency Classification 10.1.1.2)
1999

(1000 som)

Levels of Econ. Classes of State Costs	Costs	Annual Plan	Including			
			I	II	III	IV
1.1.0.1	Wages	730	182	183	183	182
1.2.1.1	Social Fund Deductions	266	66	67	67	66
1.3.1.1	Travel Expenses	16	4	4	4	4
1.3.2.1	Acquisition of Equipment, Stock and Materials	297	74	75	74	74
1.3.3.1	Water, Electricity, Gas, Telephone, Heating	142	35	36	36	35
1.3.3.3	Renting of Vehicles Maintaining of Own Vehicles	197	49	49	50	49
1.3.4.1	Other Acquisitions and Services	543	30	171	171	171
4.0.0.4	Major Repairs	3849	-	1000	1849	1000
	Total	6040	440	1585	2434	1581

Water Management Department
Ministry of Agriculture and Water Management
Kyrgyz Republic

Table A6: Performance Report of the Operational Costs Estimate for Water Systems Orto-Tokoi Reservoir Administration

Line No.	Indicators	Units	Costs	
			Plan	Report
	1. Administrative Costs			
01	Operation Personnel	Person/som	18 339600	
02	Administrative and Management Personnel	Person/som	6 123100	
03	Other Administrative Costs	som	81400	
04	Total for Part 1	som	421000	
05	Including Wages for Part 1	som	248800	
	2. Auxiliary Work			
06	Research and Design Work	som		
07	Metrological and Surveying Work	som		
08	Training, Consulting and Marketing	som		
09	Total for Part 2	som		
10	Including Wages for Part 2	som		
	3. Maintenance of Fixed Assets			
11	Water Facilities	Pieces/som	1 893710	
12	Measuring Stations	Pieces/som	3 38085	
13	Civil and Industrial Buildings	m^2/som	5785 207810	
14	Communication Equipment	som	20371	
15	Canals	km/som	-	
16	Pumping Stations	Pieces/som	-	
17	Including Electric Power Expenses	kW/som	-	
18	Irrigation Wells	Pieces/som	-	
19	Including Electric Power Expenses	kW/som	-	
20	Wells of Vertical Drainage	Pieces/som	-	
21	Including Electric Power Expenses	kW/som		
22	Vehicles and Mechanisms	Pieces/som	8 316595	
23	Compensation for Using Personal Automobiles and Motorcycles for Job Purposes	som	6000	
24	Cartage	Livestock Units/som		
25	Including Forage	som		
26	Gardens and Forest Stands	ha/som	9.5	

Line No.	Indicators	Units	Costs	
			Plan	Report
			65773	
27	Total for Part 3	som	1548344	
28	Including Wages for Part 3	som	463951	
	4. Running Repairs of Fixed Assets			
29	Water Facilities	Pieces/som	<u>1</u> 65662	
30	Measuring Stations	Pieces/som	<u>1</u> 6917	
31	Civil and Industrial Buildings	m^2/som	<u>100</u> 132476	
32	Communication Equipment	som	-	
33	Canals	km/som	-	
34	Vehicles and Mechanisms	Pieces/som	<u>5</u> 17121	
35	Pumping Stations	Pieces/som		
36	Irrigation Wells	Pieces/som		
37	Vertical Drainage Wells	Pieces/som		
38	Manual Cleaning of Irrigation Systems	Thousand m^3/som		
39	Mechanized Cleaning of Irrigation Systems	Thousand m^3/som		
40	Cleaning by Mechanisms of Collector and Drainage Flow	Thousand m^3/som		
41	Regulation and Flood Protection	som		
42	Other Activities	som		
43	Total for Part 4	som	222176	
44	Noncontracted Method	som	222176	
45	Including Wages for Part 4	som	17249	
	5. Major Repairs of Fixed Assets			
46	Water Facilities	Pieces/som	<u>1</u> 3543604	
47	Measuring Stations	Pieces/som		
48	Civil and Industrial Buildings	som		
49	Communication Equipment	som		
50	Canals	km/som		
51	Collector and Drainage System	km/som		
52	Vehicles, Mechanisms, Production Stock	Pieces/som		
53	Pumping Stations	Pieces/som		
54	Irrigation Wells	Pieces/som		
55	Vertical Drainage Wells	Pieces/som	<u>10</u> 305222	

Line No.	Indicators	Units	Costs	
			Plan	Report
56	Total for Part 5	som	3848826	
57	Noncontracted Method	som		
58	Including Wages for Part 5	som		
59	Total for Parts 1-5	som	6040346	
60	Noncontracted Method	som	2191520	
61	Total Wages	som	730000	
62	Social Fund Deductions	som	266450	
	6. Sources of Funding of Operational Costs			
63	State Budget	som	6040346	
64	Special Funds from Charged Water Delivery	som	-	
65	Other Sources	som	-	

P. M. Chernonozhkin G.S. Kutmanova End of Table A6
Head of the Organization Chief Accountant

Chu River System Irrigated Area and Water Withdrawal Data

Table A7: Service Areas of Canals of the Chu River System Serving the Kyrgyz Republic

Canal	Area Served (ha)	Canal Capacity (m3/sec)
Bypass Chu Canal – New Osmon	6,200	60
East Big Chu Canal	43,500	50
At-Bashinskiy Canal	23,200	31
Krasnaya River – West Big Chu Canal	74,300	58
Total	147,200	199

Table A8: Land Irrigated in the Kazakhstan Portion of the Chu Valley

Rayon	1995	1996	1997	1998
	Irrigated Land (1000 ha)	Irrigated Land (1000 ha)	Irrigated Land (1000 ha)	Irrigated Land (1000 ha)
Chu	39.16	29.55	28.1	22.51
Kordai	43.08	42.5	37.4	30.73
Moiylkum	14.02	8.19	6.32	4.57
Total	96.26	80.24	71.82	57.81

Table A9: Water Withdrawals from the Chu River for Kazakhstan (million m3)

Canal	1996			1997			1998		
	Growing Season	NonGrowing Season	Annual Total	Growing Season	NonGrowing Season	Annual Total	Growing Season	NonGrowing Season	Annual Total
Georgievsky Main	241.28	0	241.28	251.68	21.7	273.38	194.05	1.727	195.777
Merken Branch, West Big Chu Canal	40.02	6.86	46.88	31.09	12.69	43.78	10.43	0.70	11.13
Atbasha	0	0	0	0.417	0	0.417	0.849	0	0.849
Total	281.3	6.86	288.16	283.187	34.39	317.577	205.329	2.427	207.756

Table A10: Technical Features of Canals

Canal	Length (km)	Flow Capacity (m3/sec)	Area Served (ha)
Georgievsky Main	110.7	42.5	39,537
Merken Branch of West Big Chu	48.9	11.3	14,251
Atbasha	22	1.2	561
Left Bank	51.9	16.6	11,482
Right Bank	53.5	11.03	5,635
Tasotkul Main	52.7	50.0	17,386
Beilazar	19.6	19.0	4,856
Ak-Ik	30	5.0	2,516

Table A11: Water Withdrawals from Chu River to Serve Kazakhstan

(million m3)

Rayon	1995		1996		1997		1998	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Chu	437.6	392.3	398.9	407.6	359.4	347.7	305.8	305.0
Kordai	431.5	372.4	413.9	398.7	382.4	336.8	358.1	258.7
Moiylkum	166.1	167.2	162.0	158.9	118.7	101.4	95.6	75.4
Total	1035.2	931.9	974.8	965.2	860.5	785.9	759.5	639.1

Table A12: Water Delivery to Kazakhstan through the Bypass Chu Canal

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	-	-	-	0,4/1,0	4,3/11,5	5,5/14,3	4,8/12,9	3,0/8,0	2,6/6,7	1,0/2,7	-	-	57.1
1996 m^3 per s/ million m^3	-	-	-	0,8/2,1	2,6/7,0	5,0/13,0	5,6/15,0	5,0/13,4	3,2/8,3	1,2/3,2	-	-	62.0
1997 m^3 per s/ million m^3	-	-	-	1,5/3,9	2,6/7,0	3,4/8,8	3,0/8,0	3,0/8,0	2,9/7,5	1,6/4,3	-	-	47.5
1998 m^3 per s/ million m^3	-	-	-	0,6/1,6	0,9/2,4	3,0/7,8	5,2/13,9	4,7/12,6	1,9/4,9	1,1/2,9	-	-	46.1
1999 m^3 per s/ million m^3	-	-	-	-	1,0/2,7	4,2/10,9	4,1/11,0	3,4/9,1	1,9/4,9				38.6
Average annual water delivery													50.26

Table A13: Water Withdrawal from the Chu River through the East Big Chu Canal
Length = 95 km
Maximum flow = 42 cu m/s
Area served=43,504 ha

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	-	-	-	7,1/ 18,4	37,6/ 100,7	35,7/ 92,5	26,1/ 69,9	25,3/ 67,8	21,1/54,7	4,1/11,2	-	-	415.2
1996 m^3 per s/ million m^3	-	-	-	-	24,4/ 65,4	39,1/ 101,3	39,1/ 104,7	30,3/81, 2	16,7/43,6	2,9/7,8	-	-	404.0
1997 m^3 per s/ million m^3	-	-	1,2/3,2	22,2/ 57,7	38,4/ 102,9	38,6/ 100,1	36/96,4	26,3/ 70,4	25,7/66,1	5,0/13,4	-	-	510.2
1998 m^3 per s/ million m^3	-	-	-	5,5/ 14,3	18,9/ 50,6	36,9/ 65,6	40,3/ 107,7	41/109,8	30,2/78,3	3,5/9,4	-	-	465.7
1999 m^3 per s/ million m^3	-	-	-	2,5/ 6,5	25,7/ 68,8	37,3/ 96,7	38,9/ 104,7	42,7/ 114,4	42,7/ 110,7	-	-	-	501.8
Average annual water delivery													459.38

Table A14: Flow from the West Big Chu Canal from the Bypass Chu Canal

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	1,5/4,0	0,5/1,2	0,3/0,8	6,2/16,1	31,2/83,6	30,8/79,8	22,2/59,5	16,8/45	12,6/32,7	4,6/12,3	1,2/3,1	1,2/3,2	341.3
1996 m^3 per s/ million m^3	1,2/3,2	1,2/2,9	1,2/3,2	5,5/14,3	14,8/39,6	27,9/72,3	27,6/73,9	22,3/59,7	12,2/32,7	2,8/7,5	2,2/5,7	2,2/5,9	320.9
1997 m^3 per s/ million m^3	2,2/5,9	2,2/5,3	5,5/14,7	13,4/34,7	19,1/51,2	16,3/42,2	18,9/50,6	13,4/35,9	5,8/15	7,2/19,3	5,5/14,3	1,0/2,8	291.0
1998 m^3 per s/ million m^3	1,0/2,7	0,6/1,5	0,3/0,8	3,1/8,0	7,3/19,6	18,6/48,2	21,5/57,3	15,1/40,5	12,3/31,9	3,0/8,0	1,1/2,9	1,7/4,6	226.0
1999 m^3 per s/ million m^3	7,0/18,6	4,1/10,4	2,0/5,3	1,6/4,2	17,0/46,1	29,7/77,0	12,9/34,5	16,9/45,7	19,3/50,1				291.9
Average annual water delivery													294.22

Table A15: Flow from the West Big Chu Canal from the East Big Chu Canal

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	-	-	-	0,6/ 1,6	0,6/_,6	0,8/2,1	9,9/26,5	16,1/ 43,1	4,8/ 12,4	0,4/1/ 1	-	-	88.4
1996 m^3 per s/ million m^3	-	-	-	-	_,7/_,2	1,8/4,7	11,0/ 29,5	15,9/ 42,6	5,7/ 14,8	5,2/ 13,9	0,9/ 2,3	-	115.0
1997 m^3 per s/ million m^3	-	-	-	3,0/ 7,8	4,8/0,2	7,4/19,2	15,7/ 42,1	17,5/ 46,9	9,4/ 24,4	0,7/ 1,9	-	-	152.5
1998 m^3 per s/ million m^3	-	-	-	1,5/ 3,9	5,1/13,7	12,1/31,4	12,6/ 35,0	11,7/ 32,6	7,7/ 20,0	1,3/ 3,5	-	-	140.1
1999 m^3 per s/ million m^3	-	-	-	0,3/ 0,8	3,7/9,8	4,5/11,7	13,1/ 34,7	2,4/6,2					63.2
Average annual water delivery													111.84

Table A16: Water Withdrawal from the Chu River through the West Big Chu Canal
Length = 146 km
Maximum flow = 53 cu m/s
Area served = 86,057 ha

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	27,5/68,8	25,7/62,2	25,7/68,8	29,2/75,5	48,8/130,7	49,4/128,0	39,5/105,1	37,2/99,6	34,6/89,7	28,8/77,1	25,2/65,3	25,2/67,5	1038.5
1996 m^3 per s/ million m^3	25,2/67,5	25,2/61,0	25,2/67,5	28,4/73,6	37,5/100,4	50,3/131,6	52,1/140,7	46,3/124,0	33,1/85,8	25,8/69,1	25,2/65,3	25,2/67,5	1054.0
1997 m^3 per s/ million m^3	25,2/67,5	25,2/61,0	28,5/76,3	34,1/88,4	40,4/108,2	49,4/128,4	49,2/131,8	43,7/117,6	30,0/77,5	31,0/83,0	29,5/76,5	25,0/67,0	1082.6
1998 m^3 per s/ million m^3	25,0/67,0	23,5/67,6	25,2/67,6	27,3/70,2	32,9/88,1	47,3/122,7	50,3/134,7	48,2/129,4	44,6/115,6	32,3/86,4	28,2/73,1	28,2/75,5	1087.1
1999 m^3 per s/ million m^3	33,0/88,5	31,6/76,4	24,4/65,3	24,6/63,?	40,9/110,2	51,9/134,6	48,3/129,3	49,4/132,4	45,5/118,0				918.5
Average annual water delivery													1036.14

Table A17: Water Withdrawal from the Chu River through the Georgievsky Canal (Kazakhstan)

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	c/c	c/c	c/c	4,7 /12,1	17,4/ 45,2	15,5/ 40,2	11,5/ 29,8	9,5/24,8	9,8/ 25,4	7/18,7	9,6/ 24,8	c/c	221
1996 m^3 per s/ million m^3	c/c	c/c	c/c	3,9/ 10,1	12/ 32,1	15/ 38,9	17,7/ 46	15,7/40,8	11/ 28,6	1,7/ 4,4	c/c	c/c	200.9
1997 m^3 per s/ million m^3	c/c	c/c	c/c	7,5/ 19,5	12/ 32,7	11,6/ 30	11,7/ 31,3	13,7/36,9	11,4/ 29,7	8,17/ 21,7	3,0/ 7,9	c/c	209.1
1998 m^3 per s/ million m^3	c/c	c/c	c/c	4,6/ 11,8	8,9/ 32,7	9,7/ 25,2	11,4/ 30,6	20,4/54,9	16,9/ 43,9	3,9/ 10,1	c/c	c/c	200.2
1999 m^3 per s/ million m^3	c/c	c/c	c/c	4,33/ 11,2	13/ 34,9	16/ 41,6	18,7/ 50,2	19/50,9	12,6/ 32,7	-	-	-	221.5
Average annual water delivery													210.54

Table A18: Water Withdrawal from the Chu River through the BCC - Osmon Canal
BCC – Bypass Chu Canal

L=38 km
Qmax=60 cu m/s

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	-	-	-	12,3/ 31,9	42/112,5	41,4/ 107,3	40,8/109,3	38,7/ 103,7	30,9/ 80,1		-	-	544.8
1996 m^3 per s/ million m^3	-	-	-	7,4/ 19,2	31,9/85,4	42,0/ 108,9	42/112,5	40,7/ 109,0	27,4/ 71,0	9/24,2	-	-	530.2
1997 m^3 per s/ million m^3	-	-	1,2/ 3,2	24,4/ 63,2	41,1/110,1	42/ 108,9	42/112,5	42/112, 5	34,6/8 9,7	13,5/ 36,2	10,6/ 27,5	10,4/ 27,9	691.7
1998 m^3 per s/ million m^3	-	-	-	14,4/ 38,2	29,0/78,7	38,2/ 100	36,8/98,7	38,6/ 104,8	41/ 106,4	24,9/ 66,7	0,7/ 1,9	-	595.4
1999 m^3 per s/ million m^3	-	-	-	4,3/11,1	32,6/88,0	41,5/ 107,7	42/112,5	42/ 112,5	42/ 108,9	-	-	-	540.7
Average annual water delivery													580.56

Table A19: Water Delivery to Kazakhstan through the West Big Chu Canal

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	-	-	-	-	_,8/_ ,8	3,6/9,3	3,7/ 9,9	2,7/7,2	1,9/4,9	0,9/2,4	-	-	38.5
1996 m^3 per s/ million m^3	-	-	-	-	_,1/5,6	3,1/8,0	4,9/ 13,1	4,4/11,8	2,5/6,5	2,6/7,0	0,7/ 1,8	-	53.8
1997 m^3 per s/ million m^3	-	-	0,9/ 2,4	3,6/ 9,3	3,1/8,3	3,2/0,3	3,5/ 9,4	3,6/9,6	2,5/6,5	2,9/7,8	1,9/ 4,9	-	66.5
1998 m^3 per s/ million m^3	-	-	-	-	0,85/2,3	2,5/6,5	3,2/ 8,6	5,0/13,4	3,0/7,8	1,4/3,7	-	-	42.3
1999 m^3 per s/ million m^3	-	-	-	-	1,8/4,7	3,3/8,6	3,0/ 8,0	2,7/7,2	1,5/3,9				32.4
Average annual water delivery													46.70

Table A20: Water Withdrawal from the Chu River through the At Bashinsky Canal
L=56.3 km
Qmax=30.0 cu m/s
Wserved=22.951 ha

Years	Months												Total Volume
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995 m^3 per s/ million m^3	2,7/7,0	c/c	c/c	2,68/6,9	8,68/ 22,0	3,48/ 9,0	5,2/ 14,1	8,48/ 22,7	6,69/ 17,3	2,8/7,3	11,0/ 28,5	c/c	128.7
1996 m^3 per s/ million m^3	c/c	c/c	c/c	1,44/3,7	7,6/ 20,8	13,1/ 33,9	12,9/ 34,5	8,6/ 22,6	5,3/ 13,8	0,74/1,9	c/c	c/c	131.2
1997 m^3 per s/ million m^3	c/c	c/c	c/c	5,3/13,6	7,56/ 20,3	9,6/ 24,9	7,1/ 19,0	7,41/ 19,8	8,4/ 21,8	2,6/ 6,7	0,08/ 0,2	c/c	126.3
1998 m^3 per s/ million m^3	c/c	c/c	c/c	2,1/ 5,4	5,0/ 13,1	10,0/ 25,9	8,7/ 23,3	13,9/ 37,2	9,1/ 23,5	1,3/3,3	c/c	c/c	131.7
1999 m^3 per s/ million m^3	c/c	c/c	c/c	0,95/2,5	8,22/ 22,0	14,0/ 36,3	15,5/ 40,5	11,4/ 22,5	4,90/ 12,7				136.5
Average annual water delivery													130.88

Table A21: Water Withdrawals from the Chu River during the 1990 Calendar Year (m3 per sec)

Station	I	II	III	IV			V			VI			VII			VIII			IX			X	XI	XII
				1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
Hydromet	12.8	13.4	12.8	13.2	14.1	13.4	39.5	79.5	76.4	126	142	243	141	142	150	143	13	105	71.8	70.6	62.1	26	21	14.7
Kurdai Irrigation System Administration (UOS)																								
"Kolos"					0.82	0.72	0.54	1.78	2.1	1.75	1.51	1.51	2.3	2.01	2.1	2.1	2.1	2.1	1.63	1.51	1.57	0.75	0.45	
Dzhen Aktas				0.78	1.8	2.24	2.44	3.62	4.01	4.47	4.72	4.84	5.19	5.12	5.25	5.29	4.98	4.81	4.09	4.09	3.47	1.7		
Saharskiy							0.11	0.15	0.15	0.15	0.15	0.1	0.15	10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.03		
Biyanhu															0.2	0.2	0.2	0.2	0.2	0.2	0.2			
Tsindarin										0.1		0.41	0.6	0.71	0.65	0.6	0.4	0.39	0.37					
Vandagon								0.18	0.2	0.29	0.39	0.32	0.36	0.35	0.29	0.21	0.21	0.11	0.05	0.12	0.06			
Chu I								0.11	0.05	0.09	0.17	0.17	0.1	0.2	0.17	0.17	0.17	0.14	0.14	0.1				
Chu II							0.03	0.11	0.2	0.32	0.37	0.32	0.3	o.24	0.08	0.1	0.1	0.1	0.06					
Milyanfan	24.9	24.2	28.1	27.8	24.4	19.4	16.1	16.6	15.9	21.9	26.4	21.6	24.1	23.4	32.6	28.3	19	16.5	14.2	14.3	13.6	23	33.3	29.7
Feeding				5.95	6.25		4.1	4.36	3.77	5.61	5.22	5.01	4.91	4.66	5.88	5.32	4.84	4.23	4.18	2.57	3.13	2.08		
Georgievsky				7.85	11.1	14	16.1	16.8	15.8	19.8	22	23.9	24.2	23.1	23.4	22.7	21.3	17.8	16	14	14.2	8.72		
Uspenovsky								1.21	1.16	1.33	1.13	1.31	1.62	1.65	1.64	1.68	1.75	1.36	0.65	0.44	0.38	0.71		
Pumps								0.06	0.14		0.05	0.5	0.7	0.86	0.86	1.02	1.03	0.77	0.26	0.12				
Total:				2.63	13.7	16.9	19.1	24	23.8	28.2	30.5	33.4	35.6	34.3	34.7	34.1	32.4	27.9	23.6	20.6	19.9	11.9	0.45	
Chu Irrigation System Administration (UOS)																								
"Chapaev"	132	142	136	125	80.6	66.8	40.9	45.3	41	40.7	41.2	52	52.1	54.7	52.1	44.1	38.7	32.7	25.5	71	18.3	233	67.6	85.1
Atbashy					0.11	0.22				0.4	0.44	0.42	0.43	0.44	0.68	0.52	0.53	0.52	0.57	0.53	0.51	0.08		
Akchashogan																								
Tasotkelsky					8.65	14.7	18.5	20.4	22	24	227	28.7	31.3	32.5	27.5	16.4	17	13.3	11.8	23.5	6.56	5.6	0.12	
Left bank					5.65	7.89	10.2	12.2	13.9	13.2	14.7	15.2	18	18.6	15.8	7.23	7.63	6.64	7.33	6.24	3.33	3.93	0.12	
Right bank					3	6.8	8.26	8.17	8.15	10.8	11.8	13.5	13.3	13.9	11.7	9.2	9.39	6.67	4.46	6.29	3.23	1.67		
Tokseit																								
Tashuikul					4.92	8.35	6.23	12.5	10.3	12.7	16	16.8	14.9	14.6	13.5	13.3	12.9	9.95	7.8	5.68	2.2	2.91	0.26	
Total:					13.7	23.3	24.7	32.9	32.3	36.7	42.5	45.5	46.2	47.1	41	29.7	29.8	23.2	19.6	18.2	8.76	8.51	0.38	
Moinkum Irrigation System Administration (UOS)																								
Toksheshi																								
Beinazar																								
Kok-Zhelek																								
Ala-Aigyr																								
Ak-Ik																								
Pumps																								
Total:	1.4	1.4	1.4	1.4	1.4	?	12.2	15.2	14.4	19.7	15.8	26.3	27.9	26.9	21.5	20.7	19	17.7	15.8	7.67	5.4	5.31	0.4	
West Big Chu																								
Merken Branch					0.15	1.53	1.53	1.6	2.48	5.06	6.73	6.21	6.1	6.08	6.45	6.51	6.59	7.04	7.05	3.92	4.03	4.32	0.11	
Total Big Chu:	1.4	1.4	1.51	10.3	25.9	41	61.7	74.3	78.9	100	103	116	110	109	101	96.1	91.3	75	64.4	48.3	45.5	31.6	1.94	0.4
Total volume of water withdrawn can be calculated by the formula: W = QT where Q is flow in m3 and T is time in seconds																								

Table A22: Water Withdrawals from Krasnorechinskiy Canal

Years	Unit of Measure	Months												Total
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
1995	m^3/sec	C	C	C	01	0,73	0,43	0,18	0,23	0,23	C	C	C	
	th.m^3	C	C	C	86	694	371	171	218	199	C	C	C	1739
1996	m^3/sec	C	C	C	C	0,23	0,56	0,56	0,46	0,33	C	C	C	
	th.m^3	C	C	C	C	218	484	532	437	285	C	C	C	1956
1997	m^3/sec	C	C	C	0,03	0,4	0,61	0,63	0,5	0,42	0,14	C	C	
	th.m^3	C	C	C	26	380	527	599	475	363	133	C	C	2503
1998	m^3/sec	C	C	C	C	0,08	1,5	0,75	0,6	0,26	C	C	C	
	th.m^3	C	C	C	C	76	1296	713	570	225	C	C	C	2880
1999	m^3/sec	C	C	C	C	0,43	0,76	0,55	0,48	0,3	C	C	C	
	th.m^3	C	C	C	C	409	657	523	456	259	C	C	C	2304

Table A23: Water withdrawals from the Chu River to the West Big Chu Canal

Years	Unit of measure	Months												Total
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
1995	m^3/sec	1,5	0,5	0,3	6,17	31,23	30,8	22,23	16,93	12,63	4,6	1,2	1,2	
	th. m^3	1426	432	314	5330	26983	26611	21127	15955	10912	4372	1037	1140	115679
1996	m^3/sec	1,2	1,2	1,2	5,5	14,8	27,9	27,6	22,3	12,2	2,8	2,2	2,2	
	th. m^3	1140	1037	1140	4752	12787	24131	26259	21194	10541	2661	1901	2091	109634
1997	m^3/sec	2,15	2,15	5,5	13,36	19,1	16,34	18,85	13,44	5,76	7,17	5,53	1,0	
	th. m^3	2043	1858	5227	11543	16493	14118	17915	12773	4977	6814	4778	950	99489
1998	m^3/sec	1,0	0,62	0,30	3,12	7,27	18,64	21,45	15,1	12,32	3,0	4,62	1,66	
	th. m^{3v}	950	536	285	2696	6281	16105	20386	14361	10644	2851	3992	1578	80655
1999	m^3/sec	6,97	4,13	1,96	1,64	17,0	29,71	1292	16,87	19,34				
	th. m^3	6624	3568	1863	1417	14688	25669	12279	16033	16710				98851

Table A24: Water Withdrawals from the Krasnaya River to the West Big Chu Canal

Years	Unit of measure	Months												Total
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
1995	m^3/sec	24,2	25,2	25,2	23,05	18,32	19,02	17,44	20,56	22,23	24,16	24	24	
	th. m^3	22999	21773	23950	19915	17411	16433	16546	19540	19207	22962	20736	22810	244282
1996	m^3/sec	24,0	24,0	24,0	22,97	22,97	220,9	25,06	24,43	21,23	22,96	23	23	
	th. m^3	22810	20736	22810	19691	21831	19085	23817	23218	18343	21821	19872	21959	255893
1997	m^3/sec	23,0	23,0	23,0	20,7	21,7	33,63	31,01	30,74	24,63	24	24	24	
	th. m^3	21859	19872	21859	17885	20624	29056	29472	29215	21280	22809	20736	22810	277477
1998	m^3/sec	24,0	22,9	24,96	24,16	25,72	30,25	29,73	33,77	32,55	29,25	27,06	27,06	
	th. m^{3v}	22810	19768	23722	20874	24444	26136	28255	32095	28125	27799	23380	25718	303126
1999	m^3/sec	26,4	25,2	22,4	22,98	24,37	22,98	35,97	33,03	26,49				
	th. m^3	25091	21807	21298	19855	23161	19855	34186	31392	22887				219532

Table A25: Overall Water Withdrawals to the West Big Chu Canal through Number 9 Measuring Station

Years	Unit of measure	Months												Total
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
1995	m^3/sec	25,7	25,7	25,53	29,22	49,55	49,82	39,64	37,39	34,86	28,76	25,2	25,2	
	th. m^3	24425	22205	24264	25245	44394	43044	37673	35535	30119	27334	21773	23950	359961
1996	m^3/sec	25,2	25,2	25,2	28,29	37,77	50,02	52,69	46,73	33,43	25,76	25,2	25,2	
	th. m^3	23950	21773	23950	24443	34618	43216	50076	44412	28884	24482	21773	23950	365527
1997	m^3/sec	25,15	25,15	28,5	34,06	40,79	49,97	49,86	44,18	3039	31,17	29,53	25	
	th. m^3	23902	21730	27086	29428	37117	43174	47387	41988	26257	29623	25514	23760	402615
1998	m^3/sec	25,0	23,5	25,26	27,28	32,99	52,27	51,18	48,87	44,87	32,25	31,68	28,72	
	th. m^{3v}	23760	20304	24007	23570	30725	42241	48641	46446	38769	30650	27372	27296	383781
1999	m^3/sec	33,37	29,37	24,37	24,62	41,37	52,69	48,89	49,9	45,83				
	th. m^3	31717	25375	23161	21272	37849	45524	46465	47425	39597				318383

Tasotkel Reservoir Technical Features	
Average multi-year inflow	1350 million m^3
Total volume under normal water level	620 million m^3
Available capacity	551 million m^3
Normal water level	519 m
Dead water level	506 m
Dam length	5850 m
Height of dam	31 m
Year placed in operation	1974

APPENDIX B: TALAS RIVER SYSTEM DATA

This appendix presents a brief description of the hydrology of the Talas River, O&M costs data for the irrigation system, and provisions

Brief Hydrological Note on the Talas River

The confluence of the Uch-Koshoi and Karakol Rivers is adopted as the source of the Talas River. The Karakol River is formed by the confluence of the Uch-Chat and Koltor Rivers at the interface of the Talas and Kyrgyz Ranges. The Karakol River runs in general westward through a narrow valley (bottom is 300-600 m wide) with few tributaries flowing into it. Near the village of Kopre-Bazar, the Karakol River expands up to 2-3 km. The Uch-Koshoi River is formed by the confluence of the Chon-Koshoi and Orto-Koshoi rivers that form their flow from the Talas Range and the Orto-Too Range. Major tributaries flow in from the left side. Numerous underground waters surfacing in the form of springs and swamp areas are registered in the upper reaches of the rivers.

On the reach from the confluence of the Uch-Koshoi and Karakol Rivers to the village of Kyzyl-Adyr, the Talas River flows through a wide, up to 15 km, intermontane valley, taking almost all of its tributaries. Of them, more numerous and full flowing are the left tributaries: Kolba, Beshtash, Urmaral, Kumyshtak, and Karabura. Right tributaries are the Kenkol and Neldy rivers. Apart from the tributaries listed, numerous “karasu” flow into the Talas River. Of them, the major “karasu” are Kirovskie. Flow of virtually all tributaries is used for irrigation. After cutting a narrow gorge in the Ikele-Too Range near the village of Kyzyn-Adyr, where the dam of Kirovskoye Reservoir (Total capacity = 550 million m^3) was constructed in 1974, the Talas River again flows through a wide valley along the foot of the southern slope of the Kyrgyz Range. Having passed the western extremity of the range, the river reaches plains by the city of Taraz, where it is also used for irrigation.

Downstream on the territory of Kyrgyzstan, two shallow tributaries Kaindy and Bokair flow into the river.

The watershed area of the Talas River at Kirovskoye Reservoir is F=8,200 sq km. Flow is fed by snowmelt of seasonal snow cover, high-level glaciers, and snowed mountain tops. According to calculations, average annual flow of the Talas River at Kirovskoye Reservoir is Q=40.6 cu m/s or V=1.28 cu km in volumetric terms. With return waters (after irrigation) that depend upon the amount of water diversion, operational water resources are 1.66 cu km in an average water year. Coefficient of variation is Cv – 0.17, Cs = 2Cv.

Maximum water withdrawals from the Talas River take place mainly in June-July. The maximum average multiyear urgent withdrawal is about 120 cu m/s. The maximum withdrawal is 313 cu m/s for the 1% availability, 282 cu m/s for the 2% availability, and 209 cu m/s for the 10% availability. The highest observed withdrawals from the Talas River at Kirovskoye Reservoir are Q=233 cu m/s (1931), Q=224 cu m/s (1966), and 282 cu m/s (1972).

Table B1: Operation Schedule of Kirovskoye (Chon-Kapkinskoye) Reservoir For 1995, 1996, 1997, 1998, 1999

Years	Months												Year Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995													
1. Water Inflow cu m per sec/million cu m	23,0/60	21/55	22/57	14/36	4/10	4/10	19/49	13/34	8/21	10/26	-	22/57	160/415
2. Water Release cu m per sec/million cu m	5,0/13	29/75	34/88	22/57	48/135	42/109	50/130	42/109	21/55	7/18	5/19	4/10	309/802
3. Volume at the End of a Month million cu m	494	504	499	481	341	208	118	38	10	52	126	206	
1996													
1. Water Inflow cu m per sec/million cu m	18/47	19/49	21/55	17/44	-	-	21/55	25/65	5/13	4/10	24/62	22/57	176/457
2. Water Release cu m per sec/million cu m	3,75/10	4,0/10	40/10	7/18	33/86	50/130	52/135	44/114	23/60	9/23	4/10	33/86	267/692
3. Volume at the End of a Month million cu m	284	356	426	455	309	191	128	77	17	34	127	214	
1997													
1. Water Inflow cu m per sec/million cu m	19/49	18/47	15/39	-	6/16	10/26	15/39	14/36	7/18	7/18	21/55	22/57	154/400
2. Water Release cu m per sec/million cu m	4/10	4/10	4/10	9/23	56/146	61/159	62/161	43/112	18/47	11/29	4/10	3/8	279/725
3. Volume at the End of a Month million cu m	293	362	428	466	336	208	95	33	8,0	11	83	184	
1998													
1. Water Inflow cu m per sec/million cu m	19/49	17/44	18/47	14/36	6/16	47/122	18/47	54/140	3/8	3/8	10/26	13/34	222/577
2. Water Release cu m per sec/million cu m	2/5	2/5	2/5	7/18	43/112	53/138	59/153	52/135	46/120	49/127	21/55	7/18	343/891
3. Volume at the End of a Month million cu m	224	329	401	432	324	308	366	373	295	221	267	368	
1999													
1. Water Inflow cu m per sec/million cu m	38/99	47/122	28/73	21/55	10/26	23/60		34/88	16/42				
2. Water Release cu m per sec/million cu m	4/10	26/68	22/57	16/42	56/146	63/164	47/122	57/148	32/83				
3. Volume at the End of a Month million cu m	458	484	500	510	382	242	329	280	262				

Table B2: Water Withdrawal from the Talas River for Kyrgyzstan

Years	Months												Year Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995	0,2 0,6	0,2 0,6	0,2 0,6	3,0 7,8	16,2 43,4	15,2 39,3	11,9 31,5	8,8 23,5	5,5 14,2	1,9 5,0	0,3 0,7	0,2 0,6	167,8
1996	0,2 0,6	0,2 0,6	0,2 0,6	1,6 4,3	15,8 43,4	19,3 50,2	11,2 29,9	12,4 33,5	12,6 32,6	2,4 6,2	0,2 0,5	0,2 0,5	201,9
1997	0,3 0,3	0,4 1,2	0,3 0,8	3,2 10,2	14,8 39,8	15,6 40,5	12,2 33,7	8,6 23,1	7,9 20,4	5,0 13,2	0,2 0,6	0,2 0,6	183,6
1998	0,2 0,6	0,2 0,6	0,2 0,6	1,2 3,1	18,0 32,4	23,2 34,3	12,4 33,2	10,7 28,4	12,2 31,6	4,1 10,6	0,2 0,6	0,2 0,6	276,6
1999	0,2 0,6	0,2 0,6	0,2 0,6	4,1 10,7	11,9 31,0	11,9 31,0	3,6 31,0	10,7 28,8	8,1 20,9				

(1) It was understood that these withdrawals from the Talas River took place below the Kirovsk (Chon-Kapkin) Reservoir,but that was not verified.

Table B3: Average Monthly Water Withdrawals and Water Delivery to Kazakhstgan From Chon-Kapkin (Kirovsk) Reservoir, Talas River System

Years	Months												Year Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1995	9,5 24,5	8,.7 21,1	8,5 22,7	15,1 39,1	1,2 37,1	40,9 106,0	47,6 127,5	39,5 105,8	22,8 59,1	12,1 32,3	12,.8 33,3	9,6 25,7	734,2
1996	8,2 21,2	8,0 20,8	8,4 22,5	12,0 31,2	3,5 16,6	50,3 120,3	49,7 133,0	42,0 112,6	24,4 63,3	11,6 31,0	9,3 24,2	7,7 20,6	727,3
1997	8,0 20,8	7,4 19,1	7,9 21,2	11,1 28,8	5,7 22,4	44,8 116,2	48,0 128,6	31,2 83,6	12,8 33,1	10,8 28,8	8,9 23,1	7,2 19,3	645,0
1998	7,1 18,3	7,3 18,8	7,4 19,8	11,2 29,1	34,9 93,5	38,9 100,7	44,8 119,9	39,4 105,6	28,7 74,3	15,1 40,4	9,2 24,0	11,2 30,0	658,4
1999	7,1 18,4	8,7 22,6	10,5 28,0	11,7 30,2	47,4 127,0	50,3 130,3	34,7 92,9	46,2 123,8	26,1 67,6	6,6 17,6			

Table B4: Register of Average Multi-year Water Consumption At measuring stations along the Talas River, 1966-76

(million m3)

Stations	Growing Season	Non-growing Season	Annual Total
Chat-Baras	219.84	66.14	285.98
Kirovsky	641.4	388.9	1030.0
Pokrovka (1970-75)	356.9	355.4	712.3
Chyerniy Kamen (Black Stone) before 1967	471.1	388.4	859.5
Discharge at point 205	251.8	407.2	659.0
Withdrawal at water control structure	256.3	84.8	341.1
Total for Water Control Structure	508.1	492.0	1001.1
Shapovalovka	139.3	343.7	483.0
Temirbek Discharge	138.9	401.6	540.5
Withdrawal at Temirbek Structure	19.4	2.0	16.41
Total for Temirbek Structure	153.38	403.6	556.98
Dzheimbet Discharge	166.3	357.0	523.3
Withdrawal at Dzheimbet	31.31	11.79	43.1
Total for Water Control Structure	197.7	368.75	566.45

Note: Entries were copied from a hand written draft. Totals may not add up. Since the discrepancies could not be precisely identified, no attempt was made to correct them.

Table B5: Technical Features of Canals Serving Zhambul Oblast, Kazakhstan from the Talas River

Canal	Total Irrigated and (Regularly Irrigated) Areas ha	Canal Capacity m3/sec	Canal Length km
Zhambul Rayon			
Kozh	937	2.5	6.8
Akzhar	921	1.2	4.1
Tneite	4,031	6.0	24.0
Kapal	11,277	22.5	78.86
Subtotal	17166		
Baizakskiy Rayon			
Bazarbai	6689	19.0	65.4
Left Bank (bypass)	12,101	34.0	83.3
Senkibai	1,644	10.0	21.0
Aitkul	217	0.2	---
Sveklovinny	1,047	1.2	3.3
Medeu	1,311	0.8	---
Mihailovskiy	1,035	2.0	9.8
Kuntu	1,852	1.5	9.0
Satualdy	1,211	1.3	---
Sambet	2,169	0.4	9.4
Baizak	2,805	0.7	---
Tyuryakeldy	796	2.7 (5.0?)	33.2
Temirbek	1,664	?	---
Subtotal	32,942		
Talas Rayon			
Zhembet	4,359 (4061)	5.95	5.60
Burebai	228	0.50	---
Zhumabek	1,632 (265)	4.52	20.0
Bahtymbet	78	0.15	---
Subtotal	6,297 (4,632)		
TOTAL	56,405 (54,740)		

Data provided by Zarybaeva G. G., Water Use Specialist, 21 Oct 1999

Table B6: Actual Water Withdrawals from Talas River for Irrigation In Zhambul Oblast, Kazakhstan

Year	Month during the Growing Season (m3/sec)										
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average (m3/sec)	Annual Volume (mln m3)*
Zhambul Rayon											
1996	---	1.46	3.16	3.99	3.54	1.24	---	---	---	1.1	34.7
1997	---	9.64	13.15	13.63	11.52	4.46	4.08	2.17	---	4.9	154.5
1998	1.31	7.77	8.99	11.43	9.91	4.84	2.7	1.2	---	4.0	126.0
Three year average annual volume											105.1
Baizakskiy Rayon											
1996	3.60	30.33	35.3	37.23	32.00	22.43	9.52	2.17	---	14.50	457.3
1997	2.92	29.70	32.47	33.50	26.67	12.55	9.07	2.63	---	12.55	395.8
1998	7.91	21.80	27.60	31.20	28.00	13.70	9.49	5.68	6.49	12.40	391.0
Three year average annual volume											414.7
Talas Rayon											
1996	0.47	2.38	2.89	2.88	1.22	0.43	0.09	---	---	0.87	27.4
1997	0.37	1.37	2.25	1.46	0.93	0.68	0.11	---	---	0.59	18.6
1998	na	na	na	na	na	na	na	na	na	na	na
Three year average annual volume not calculated											

* Note: Annual volume calculated with the formula: W = Q x T where Q = annual average flow in m3/sec and T = seconds per 365 day year.

Table B7: Water Discharge from Kirovsk (Chon-Kapkinskoye) Reservoir To Territories of Kazakhstan and Kyrgyzstan (mln m3)										
	1995		1996		1997		1998		1999	
Month	Kazak	Kyrgyz	Kazak	Kyrgyz	Kazak	Kyrgyz	Kazak	Kyrgyz	Kazak	Kyrgyz
January	13.92	---	10.06	0.53	8.58	0.81	6.1	0.53	10.37	0.53
February	67.3	---	10.03	0.5	7.5	0.98	5.02	0.45	63.5	0.48
March	88.3	---	10.7	0.55	8.64	0.75	5.9	0.53	57.7	0.53
April	63.2	---	17.94	4.46	14.87	9.11	16.3	2.9	34.1	9.9
May	124.13	38.47	108.3	42.2	114.1	36.3	87.3	32.6	126.1	28.0
June	108.6	37.9	130.1	50.6	118.3	41.0	101.8	34.4	128.9	31.2
July	131.9	30.2	137.7	30.9	133.7	32.8	124.5	31.5	102.3	23.2
August	111.6	23.3	119.9	30.9	88.7	22.5	109.9	28.9	118.9	28.6
September	52.5	15.9	59.76	34.52	26.9	20.2	88.7	31.9	61.26	21.7
October	17.93	5.48	17.5	6.9	15.6	13.5	117.9	13.9	12.5	11.6
November	13.3	0.8	12.8	0.39	9.89	0.85	57.6	0.7	---	---
December	11.29	0.53	9.09	7.0	7.43	0.36	18.6	0.53	---	---
Annual	804.07	152.78	643.88	241.06	554.21	179.16	739.62	231.31	715.63	144.14

Table B8: Water Consumption at Measuring Station Pokrovka (mln m3)													
	Month												Annual
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1995	11.3	68.2	95.0	58.8	131.8	108.3	133.2	112.9	52.9	20.8	20.5	14.73	828.43
1996	10.4	8.13	7.31	22.9	111.3	132.7	138.5	117.9	55.7	17.3	11.3	7.51	640.95
1997	7.33	5.79	6.6	18.25	116.6	118.5	126.9	86.3	25.9	15.24	10.15	5.86	538.22
1998	4.89	5.5	5.13	18.6	88.0	103.1	125.2	111.1	89.1	116.2	55.64	---	722.43
1999	?	?	?	?	?	?	?	?	?	?	?	?	
Annual average total for years 1995-98													682.08

Note: Due to lack of financial resources in Zhambylvodhoz to pay Kazgidromet for its services, the latter has not provided information since December, 1998.

Table B9: Water Withdrawals from the Talas River for Irrigation										
	1995		1996		1997		1998		1999	
Itm	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Withdrawal from the Talas River (mln m3)	660.3	554.3	677.7	589.0	644.3	512.2	617.6	466.7	---	---

APPENDIX C: TOKTOGUL RESERVOIR DATA

Table C1: Total Annual O&M Costs of Toktogul and Uch-Kurgan Water Control Structures of Joint Use

(Report for 1998)

Types of Costs	Toktogul Structure (1000 som)	Uch-Kurgan Structure (1000 som)	Total Costs
1. Basic productive wage	1400.0	233.4	1633.4
2. Social insurance deductions from the basic wage	476.1	79.4	555.5
1. Operation and maintenance o equipment	41,545.3	6,924.2	48,469.5
4. Departmental overhead	4,545.9	757.6	5,303.5
5. Structure overhead	30,373.4	5,062.2	35,435.6
Maintenance (items 3,4,5)	9,215.6	1,539.9	10,755.5
Capital Repairs:	7,094.9	1,182.5	8,277.4
Buildings	141.0	209.0	350.0
Water facilities	4,315.0	652.8	4,967.8
Equipment	2,638.9	320.7	2,959.6
Total Costs	77,991.4	12,998.6	90,990.0
Tangible costs	16,325.0	2,720.8	19,045.8
Industrial work and services	7,624.4	1,270.7	8,895.1
Supplies	6,696.4	1,116.2	7,813.6
Combustible and lubricating materials	1,866.5	311.1	2,177.6
Energy	136.7	22.8	159.5
Wages fund	8,989.9	1,498.3	10,488.2
Social insurance	2,737.5	456.3	3,193.8
Fixed assets depreciation	23,448.4	3,908.1	27,356.5
Other costs and contingencies	26,490.7	4,415.0	30,905.7
Supplementary costs			
Medical insurance (2%)	179.5	29.9	209.4
Employment fund (1.5%)	134.7	22.5	157.2
Effluent charges (emissions)	35.4	5.9	41.3
Total Costs	78,341.0	13,056.9	91,397.9
Flood Zone compensation contributions	16,800	---	16,800
R&D	1,650.0	300.0	1,950.0
Hydrological and meteorological data	36.0	---	36.0
GRAND TOTAL	96,827.0	13,357.0	110,184.0

Table C2: Water and Energy Operation Mode of Toktogul Reservoir (1995-1999)

Item	1995	1996	1997	1998	1999 (anticipated)
	Inflow to Toktogul Reservoir (billion m^3)				
Annual	10.89	13.75	10.83	14.49	13.70
Fall and winter	3.09	2.8	2.96	2.58	3.24
Growing period	7.88	10.99	8.09	11.5	10.93
	Releases from Toktogul Reservoir (billion m^3)				
Annual	14.62	14.60	13.68	11.16	12.95
Fall and winter	8.3	7.8	8.36	7.12	7.94
Growing period	6.33	6.23	6.08	3.68	5.12
Additional amount	2.30	2.27	2.27	0.66	1.51
	Transfer of Electric Power Generated through Extra Releases from Toktogul Reservoir				
Total	1710	2072	2325	958	1453
Kazakhstan	782	995	710	469	483
Uzbekistan	928	1077	1615	489	970

Table C3: Water Flow through Uch-Kurgan Water Structure

Month	Water Structure Releases				
			To Irrigation Canals		
	Total m^3/sec	Through HPS m^3/sec	m^3/sec	Million m^3	Underproduction (million kWh)
Sept 1998	306.5	256.5	50	129.6	9.26
Oct	363.68	328.68	35	93.74	6.70
Nov	442.53	413.53	29	75.17	5.37
Dec	563.32	554.32	9	24.11	1.72
Jan 1999	645.45	642.45	3	8.04	0.57
Feb	555.61	551.61	4	9.68	0.69
Mar	557.55	540.55	17	45.53	3.25
Apr	504.07	487.07	17	44.06	3.15
May	356.68	316.68	40	107.14	7.65
Jun	350.67	305.67	45	116.64	8.33
Jul	500.58	444.58	56	149.99	10.71
Aug	446.77	384.77	62	166.06	11.86
Total	---	---	---	969.76	69.26

Table C4: Land Resource and Irrigated Areas in the Syr Darya Basin (1000 ha)

Water Rayons, Republics, & Irrigated Areas	Total Area	Available for Irrigation	Irrigated in 1970	Irrigated in 1975	Projected for Irrigation	Free Lands
Area I: Upstream from Toktogul Reservoir						
Upper reaches of Naryn River	5228	270	122	112	119	157
Area II: Toktogul to Kairakum						
Fergana Valley	8954	1539	1066	1156	1261	278
Area III: Middlestream Area (Kairakum to Chardara)						
Dalverzinskaya	---	84	43	43	44	40
Golodnaya	---	795	490	591	595	200
Jizakskaya	---	255	---	20	120	135
Farishskaya	---	172	---	---	---	172
Total Middlestream	3405	1306	533	654	759	547
Chirchik-Angren-Keles	2564	722	365	375	466	256
Total Area III	5969	2028	898	1029	1225	803
Area IV: Downstream from Chardara Reservoir						
Arys-Turkestan	3605	1601	160	176	186	1415
Lower Reaches	20637	7939	141	233	350	7589
Total Area IV	24242	9540	301	409	536	9004
BASIN TOTAL	44393	13383	2357	2706	3141	10242
Distribution by Republic						
Uzbekistan	6204	2565	1386	1656	1785	780
Kyrgyzstan	11954	617	316	342	366	251
Tajikistan	1232	359	170	195	229	130
Kazakhstan	25003	9842	475	584	761	9081
Additional in the Lower Reaches						
Pasture flooding	---	---	---	---	4000	---
Flood catchwork	---	---	---	---	400	---

Data were taken from the adjusting note made by the Sredazgiprovodkhlopok Institute for the Diagram of Syr Darya of 1972. The note was made according to the Protocol of the Research Engineering Service, Ministry of Water Management, USSR, W129, of February 22-23, 1972, as reported in "Concepts of Water Use Rules for the Naryn-Syr Darya Cascade of Reservoirs", GLAVNIIPROEKT-GIDROPROEKT, Book 1, Main Provisions, Tashkent 1977.

APPENDIX D: Kairakum Reservoir Data

The Kairakum Reservoir, consisting of the hydraulic power system and reservoir, is designed for the Syr Darya flow seasonal regulation to satisfy the needs of the energy sector and irrigated cotton-growing areas of the Fergana Valley, Golodnaya and Dalverzinskaya steppes.

Being the umbilical reservoir in the Syr Darya basin, the Kairakum Reservoir irrigates 270 thousand ha of the cotton-growing lands and 75 thousand ha of the Syr Darya lower reaches in the rice-growing regions of Central Asia.

The efficiency of the reservoir is characterized by the technical and economic indices presented in Table D1.

Table D1: Kairakum Reservoir Parameters

• Full storage	3511 million m^3
• Effective storage	2743 million m^3
• Dead storage	0.894 million m^3
• Surface area at 374.5 m level	514 km^3
• Length	about 65 km
• Width	from 8 km to 20 km
• Installed generating capacity	126 MW
• Long term average power generation	668 million kWh
• Hours of installed capacity use	5076 hours
• Water discharge per kWh of generation	24 m3
• Max. water discharge (0.1% probability)	4400 m^3 /sec
--- Through the turbines	1080 m^3 /sec
--- Through the HPP by-pass gates	3320 m^3 /sec

Table D2: Total Annual O&M Costs of the Kairakum Water Structure (Report for 1998)

Costs	Amount of Costs (Tajik rubles)
1. Major Wages of Production Workers	17,281,586
2. Social Insurance Deductions from Wages (25% + 1% pension fund)	598,807
3. Operation and Maintenance of Equipment	203,589,768
4. Departmental Overheads	19,186,566
5. Structure Overheads	206,261,921
Running Repairs	127,888,828
Major Repairs	78,373,093
Total	446,918,648

Table D4: Water Withdrawalsfrom Kairakkum Reservoir and the Syr Darya River within the Boundaries of the Republic of Tajikistan

Canal (Pump Station)	Source (reservoir, river)	Irrigated Area, thousand ha			Water Withdrawals, million cu m					
			Including		Growing Season			Ungrowing Season		
						Including			Including	
		Total	Tajikistan	Other Republics	Total	For Tajikistan	For Other Republics	Total	For Tajikistan	For Other Republics
Khodzha Bakirgan Pump Station-1 Kh. B.-1	Kairakkum Reservoir	18.62	18.62	?	263.68	239.68	24.0	?	?	?
Khodzha Bakirgan Pump Station-2 Kh. B.-2	Main Canal	12.74	12.74	?	72.88	42.88	24.0	?	?	?
Khodzha Bakirgan Main Canal-2		12.74	12.74	?	72.88	48.88	24.0	?	?	?

Received 25Nov99

10.31.99

Table D5: Withdrawals from Kairakum Reservoir
(units ?)

Year	Month 1	2	3	4	5	6	7	8	9	10	11	12
Asht Pump Station10												
1986	0.00	0.00	11.15	24.05	23.09	28.38	38.33	40.11	25.59	12.48	1.73	0.00
1987	0.00	0.00	21.80	19.88	33.21	29.60	32.80	35.14	18.35	6.21	0.00	0.00
1988	0.00	0.00	15.13	32.01	34.12	35.58	43.57	26.46	10.19	7.74	0.00	0.00
1989	0.00	0.00	11.22	24.21	23.24	28.56	38.59	40.38	25.24	12.56	1.81	0.00
1990	0.00	0.00	9.43	26.99	23.58	32.58	39.26	40.96	23.14	9.37	0.00	0.00
1991	0.00	0.00	0.23	25.35	27.46	37.25	46.13	47.86	25.65	14.44	0.48	0.00
1992	0.00	0.00	8.42	19.27	32.50	35.91	38.09	37.92	12.12	10.20	0.00	0.00
1993	0.00	0.00	10.00	25.01	21.02	23.30	32.63	40.11	19.46	9.26	0.00	0.00
1994	0.00	0.00	16.31	26.10	33.33	36.17	39.94	29.44	22.01	12.00	1.92	0.00
1995	0.00	0.00	10.27	22.16	22.96	22.15	35.33	36.97	23.56	11.49	1.66	0.00
Upper Dalverzin												
1986	0.00	0.00	0.00	26.91	79.13	95.73	112.79	104.71	45.97	17.02	11.34	0.00
1987	0.00	0.00	0.00	1.04	57.88	100.28	104.00	107.80	47.90	12.18	0.00	0.00
1988	0.00	0.00	0.00	26.08	76.70	92.79	109.32	101.26	44.56	16.50	10.99	0.00
1989	0.00	0.00	0.00	37.09	80.02	105.62	115.93	112.13	47.69	15.24	0.00	0.00
1990	0.00	0.00	0.00	0.00	66.71	108.98	105.51	108.30	47.61	13.52	0.00	0.00
1991	0.00	0.00	0.00	20.99	86.86	111.30	117.93	113.34	57.93	19.75	4.46	0.00
1992	0.00	0.00	0.00	3.25	78.07	108.35	108.15	111.32	46.09	15.13	7.15	0.00
1993	0.00	0.00	0.00	24.89	65.18	101.26	116.25	100.56	51.64	17.18	0.00	0.00
1994	0.00	0.00	0.00	35.12	84.68	95.59	105.00	106.38	47.15	18.37	5.62	0.00
1995	0.00	0.00	0.00	24.07	70.79	85.65	100.90	93.47	41.13	15.23	10.14	0.00
Degmai 1 Pump Station												
1986	0.00	0.00	0.28	8.25	15.69	20.25	23.14	20.96	13.54	3.62	0.00	0.00
1987	0.00	0.00	0.99	1.37	12.37	12.08	14.41	20.78	9.82	1.45	0.00	0.00
1988	0.00	0.00	4.50	13.76	17.46	19.05	23.23	21.84	13.04	1.90	0.00	0.00
1989	0.00	0.00	1.39	11.02	13.90	22.71	23.22	22.71	12.86	2.94	0.00	0.00
1990	0.00	0.00	1.34	7.06	19.00	20.37	23.34	22.12	11.74	2.55	0.00	0.00
1991	0.00	0.00	0.29	14.45	18.40	21.76	23.42	22.53	13.10	4.67	0.00	0.00
1992	0.00	0.00	0.32	2.17	12.29	19.23	23.15	20.23	12.34	2.08	0.00	0.00
1993	0.00	0.00	0.91	9.19	16.97	21.00	22.88	22.68	11.65	1.75	0.00	0.00
1994	0.00	0.00	1.30	10.23	19.54	19.93	20.50	21.62	13.20	3.03	0.00	0.00
1995	0.00	0.00	2.11	13.10	17.80	20.72	23.23	22.04	11.03	2.37	0.00	0.00
Kirovskaya Pump Station (Mehnat)												
1986	0.00	0.00	0.00	1.69	10.61	10.84	13.13	13.52	9.30	0.69	0.00	0.00

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1987	0.00	0.00	0.00	0.00	4.58	6.23	7.52	8.17	5.91	0.05	0.00	0.00
1988	0.00	0.00	0.00	1.94	6.03	5.70	7.63	7.79	4.20	0.00	0.00	0.00
1989	0.00	0.00	0.00	2.41	7.39	8.37	11.19	10.87	7.39	0.29	0.00	0.00
1990	0.00	0.00	0.00	1.27	7.98	8.16	9.88	11.14	7.00	0.52	0.00	0.00
1991	0.00	0.00	0.00	1.81	8.75	10.06	12.31	11.68	8.55	0.00	0.00	0.00
1992	0.00	0.00	0.00	1.21	5.88	6.43	8.85	10.49	5.57	0.00	0.00	0.00
1993	0.00	0.00	0.00	1.46	6.23	6.27	7.76	11.41	7.30	0.00	0.00	0.00
1994	0.00	0.00	0.00	1.52	7.07	9.08	11.16	11.30	13.72	7.00	0.41	0.00
1995	0.00	0.00	0.00	1.35	8.49	8.68	10.52	11.68	7.45	0.55	0.00	0.00
Mahram Pump Station												
1986	0.00	0.00	3.99	8.53	8.30	15.60	16.17	14.82	9.54	5.45	0.00	0.00
1987	0.00	0.00	4.71	0.31	8.86	10.24	19.57	18.99	2.44	1.39	0.00	0.00
1988	0.00	0.00	4.20	7.31	2.25	17.29	22.68	20.54	9.67	3.99	0.00	0.00
1989	0.00	0.00	4.21	6.97	8.73	15.84	17.28	15.58	10.03	5.76	0.00	0.00
1990	0.00	0.80	5.17	5.74	4.91	14.83	19.92	14.06	5.94	1.32	1.55	0.50
1991	0.00	0.00	0.29	9.43	8.13	15.91	23.00	17.18	11.34	1.41	1.56	0.46
1992	0.00	0.00	0.67	5.26	6.42	11.80	16.60	15.75	10.75	3.98	0.00	0.00
1993	0.00	0.00	3.14	7.41	8.06	14.52	19.34	14.98	6.99	3.62	0.00	0.00
1994	0.00	0.00	4.01	8.92	8.99	15.73	20.99	18.14	7.64	4.04	0.00	0.00
1995	0.00	0.00	3.58	7.65	7.45	13.52	14.51	13.29	8.56	4.89	0.00	0.00
Nau Pump Station												
1986	0.00	0.00	0.00	3.56	8.22	11.24	13.37	13.94	3.83	0.43	0.00	0.00
1987	0.00	0.00	0.00	0.03	5.81	8.98	9.13	10.26	4.46	1.78	0.00	0.00
1988	0.00	0.00	0.00	3.76	8.01	8.74	10.23	9.75	6.04	0.28	0.00	0.00
1989	0.00	0.00	0.21	4.59	5.09	9.85	11.36	11.19	5.52	0.50	0.00	0.00
1990	0.00	0.00	0.00	2.89	6.67	9.12	10.85	11.89	3.11	0.35	0.00	0.00
1991	0.00	0.00	0.00	2.20	7.63	9.07	10.24	10.99	3.20	0.00	0.00	0.00
1992	0.00	0.00	0.00	2.01	5.85	7.54	9.16	10.00	5.69	0.00	0.00	0.00
1993	0.00	0.00	0.00	2.13	5.64	8.96	11.00	13.00	4.49	0.30	0.00	0.00
1994	0.00	0.00	0.00	3.43	6.94	9.16	10.56	11.92	5.76	0.44	0.00	0.00
1995	0.00	0.00	0.00	3.25	7.49	10.25	12.19	13.35	3.45	3.90	0.00	0.00
Samgar Pump Station												
1986	0.00	0.00	7.46	20.19	26.72	30.34	32.60	32.40	16.72	9.03	3.52	0.00
1987	0.00	0.00	5.79	15.73	26.00	26.72	27.95	28.49	14.26	8.04	1.37	0.00
1988	0.00	0.00	8.46	21.72	23.97	27.84	31.47	31.15	21.05	10.71	1.32	
1989	0.00	0.00	3.48	22.58	25.28	29.06	33.35	32.70	16.69	7.93	4.38	0.00
1990	0.00	0.00	1.12	17.81	23.27	26.62	33.67	32.80	17.21	16.33	0.00	0.00
1991	0.00	0.00	0.70	20.08	26.85	31.31	33.50	31.82	20.80	13.68	6.97	0.00
1992	0.00	0.00	1.03	15.97	23.37	26.04	31.91	32.99	16.21	10.42	0.00	0.00
1993	0.00	0.00	2.12	16.64	23.24	27.13	30.78	33.40	18.93	9.16	1.65	0.00
1994	0.00	0.00	6.51	20.84	24.24	27.92	33.81	32.26	21.03	15.67	3.19	2.49
1995	0.00	0.00	7.00	22.12	26.18	30.48	33.95	31.77	20.00	17.27	3.86	3.17
Undzhi Pump Station												
1986	0.00	0.00	2.11	3.51	4.02	5.23	7.95	8.19	4.08	1.60	0.00	0.00

Table continued on next page

1987	0.00	0.00	1.58	0.96	4.29	4.85	5.55	7.88	3.52	0.70	0.00	0.00
1988	0.00	0.00	2.52	3.60	2.76	5.73	8.30	8.52	3.60	1.55	0.00	0.00
1989	0.00	0.00	0.70	3.60	3.53	4.74	6.13	7.21	3.26	1.12	0.56	0.00
1990	0.00	0.00	0.70	2.33	3.22	5.29	7.23	6.46	3.65	0.67	0.21	0.00
1991	0.00	0.00	0.26	3.63	3.25	4.91	8.03	8.18	4.37	1.01	0.00	0.00
1992	0.00	0.00	0.32	1.07	2.82	4.92	6.66	7.01	3.63	0.90	0.00	0.00
1993	0.00	0.00	0.45	1.62	2.93	4.76	6.16	7.24	3.78	1.10	0.00	0.00
1994	0.00	0.00	1.72	3.29	3.67	5.35	8.00	8.50	4.44	1.17	0.00	0.00
1995	0.00	0.00	2.50	3.35	4.02	4.22	7.63	8.67	4.92	1.52	0.00	0.00
Chumchuk Dzhar												
1986	0.00	0.00	3.44	9.70	2.48	9.96	10.46	14.99	10.72	7.35	4.53	0.00
1987	0.00	0.00	5.81	5.57	4.98	5.68	8.20	10.00	9.56	4.35	0.00	0.00
1988	0.00	0.83	7.35	7.44	2.95	8.01	12.70	10.65	10.80	6.27	0.00	0.00
1989	0.00	0.00	2.60	7.10	1.87	7.52	8.03	13.20	8.09	5.54	3.42	0.00
1990	0.00	0.00	1.61	6.32	1.26	9.90	11.25	10.96	7.00	3.35	0.00	0.00
1991	0.00	0.00	0.74	10.37	7.08	9.87	11.49	13.01	11.01	4.10	1.43	0.96
1992	0.00	0.00	1.19	5.17	6.60	7.63	10.98	11.42	8.82	5.16	0.00	0.00
1993	0.00	0.00	2.63	6.39	7.14	8.07	13.29	12.16	9.01	4.00	0.00	0.00
1994	0.00	0.00	5.12	7.34	7.97	9.00	11.19	13.80	7.93	6.33	1.82	0.00
1995	0.00	0.00	2.91	7.36	2.09	8.43	8.99	12.69	9.07	6.21	3.83	0.00

End of Table D5

Table D6: Major Canals and Facilities in Tadjikistan

No.	Irrigation System	$m^3/s/ha$	River
I Asht Irrigation System			
1	North Fergana Canal	8.0/2086	Syr Darya
2	Chumchuk Dzhar Pump Station	5.0/2088	Syr Darya
3	Uzbek Dzhar Pump Station	1.2/2083	Syr Darya
4	Asht Pump Stations	24.0/2042	Syr Darya
II Isfara Irrigation System			
1	Kadon Canal	2.5/8.0	Kshemysh
2	Maidon Canal	2.0/4.0	Kshemysh
3	Aksai Canal	2.5/62.0	Isfara
4	Machak Canal	2.5/55.0	Isfara
5	Dam Canal	4.0/37.0	Isfara
6	Tortgul Canal	21.0/57.0	Isfara
7	Kairma Canal	1.2/50.0	Isfara
8	Pshemak Canal	2.5/43.0	Isfara
9	Chorkishlak Canal	1.5/40	Isfara
10	Diversion Canal (Kulkent, Chilgazy, Matpari)	19.0	Isfara
11	50 years of the October Pump Station	3.0/36.0	Isfara

Table D6: Major Canals and Facilities in Tadjikistan

No.	Irrigation System	m^3/s/ha	River
12	Kuruk Canal	1.2/30.0	Isfara
13	Novaton Canal	1.2/29.0	Isfara
14	Balat Canal	2.0/28.0	Isfara
15	ZartkhokCanal	2.5/20.0	Isfara
16	Rapkan Canal for Uzbekistan	60.0/1.0	Isfara
17	Novyi Canal	24.0/1.0	Isfara
18	Ravat 1 and 2	1.5/1.0	Isfara
19	Kanibadam Canal	27.0/1.0	Isfara
20	Kuchkak Canal	20.0/1.0	Isfara
21	Big Fergana Canal	20.0/2010.0	Syr Darya
22	Poimennaya Pump Station	1.5/2007	Syr Darya
23	Mahram Pump Station with Feeding through Collectors		Syr Darya
	III Khodzha Bakirgan Irrigation System		
1	Samgar Pump Stations	11.5/1960	Syr Darya
2	Khodzha Bakirgan Pump Stations	26.6/1970	Syr Darya
3	Unzhi Pump Station	3.3/1950	Syr Darya
4	Digman-1 Pump Station	9.10/1920	Syr Darya
5	Kzyl Tukai Pump Station	2.0/1933	Syr Darya
6	Aktash Pump Station	2.0/1924	Syr Darya
7	Mahram Pump Station	9.0/1983	Syr Darya
8	Gulikandoz Main Canal	32/32	Khodzha Bakirgan
	IV Matchin Irrigation System		
1	Upper Dalverzin Main Canal (with a system of machine canals)	44.0/1902	Syr Darya
	V Nau Irrigation System		
1	Diversion Canal	-/1902	Syr Darya
2	Novaya Pump Station	5.0/1902	Syr Darya
	Table continued on next page		
1	Kirovskaya Pump Station	5.5/1902	From a diversion canal
2	Novyi Shavkat Canal	8/15	Aksu
	VI Zafarabad Irrigation System		
1	TM-1 Main Canal	14.5/1902	From a diversion canal
2	Kizili Pump Station	31.7/1902	From a diversion canal
	VII Katta Sai Irrigation System		
1	Basmandy Canal	3.0/28	Katta Sai
2	Shahristan Feeding Canal	1.5/28	Katta Sai
3	Daganasai Main Canal	5.0/40.0	Shirin Sai
4	Katta Sai Main Canal	6.0/27	Katta Sai
5	Basmandy Canal	3.0/60	Shirin Sai

End of Table D6

APPENDIX E: PROVISIONS, REGULATIONS, DRAFT AGREEMENTS, PROTOCOLS, AND POSITIONS

E.1 PROVISIONS of the Flow Allocation in the Chu River Basin,
Ministry of Melioration and Water Management of the USSR,
Moscow, 1983.
Approved by E.E. Borodavchenko, Deputy Minister of
Melioration and Water Management,
February 24, 1983.

1. Provisions of the Flow Allocation in the Chu River Basin is completed on the basis of the flow allocation between the Republics, established by the Ministry of Water Management of the USSR of April 27, 1981, No. 1/1-36-427(428): 42% of the total water amount are intended for the Kazakh SSR and 58% for the Kyrgyz SSR.
2. All water resources of the Chu River Basin are subject to allocation, irrespective of the region of their formation and use. In average water years the water totals to 6640 mln.cu. M, including 4863 mln. Cu.m of natural water and 1777 mln.cu.m of return water.
3. Table 1 shows basin's water resources allocation to all water consumers of the two Republics:

Table 1. Chu River Basin Water Resource Allocation

Republic	Units	Growing Season (Apr-Sep)	Non-Growing Season (Oct-Mar)	Annual
Kazakh SSR	mln.cu.m	1540	1250	2790
	%	34	60	42
Kyrgyz SSR	mln.cu.m	3017	838	3850
	%	66	40	58
Total	mln.cu.m	4557	2083	6640
	%	100	100	100

4. A routine flow allocation between the Republics shall be made only along the Chu channel on the following reaches: Orokoi-Gilaryk, Gilaryk-Tokmak-Chumysh, Chumysh-Tashutkul.

   The flow of mountain rivers shall be used by the Republics owning the territory where the specified rivers run through. This includes the mountain water flow of the total flow diverted from the Republics in the Chu basin.

   Limits for water diversion by the Kazakh SSR and the Kyrgyz SSR on the reaches and water sources of the Chu river basin shall not exceed the figures shown in Table 2.

Table 2. Norms (limits) of Water Diversion for the Kazakh SSR and the Kyrgyz SSR in Average Water Years (mln.cu.m)

Water Diversion Sources	Upstream from Ortokoi Reservoir			Ortokoi-Gilaryk Reach			Gilaryk-Tokmak Reach			Tokmak-Chumysh Reach			Chumysh-Tashutkul Reach			Tashutkul-Furmanovo Reach			Downstream Furmanovo			Basin Total		
	Months			Months			Months			Months			Months			Months			Months			Months		
	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr	IV-IX	X-III	Yr
Chu River to:																								
Kazakh SSR	0	0	0	0	0	0	81	17	98	252	102	353	138	17	155	704	75	779	48	975	1023	1223	1186	2409
Kyrgyz SSR	183	64	247	44	7	51	666	52	718	728	364	1092	106	40	146	0	0	0	0	0	0	1727	527	2254
Total	183	64	247	44	7	51	747	69	816	980	466	1446	244	57	301	704	75	779	48	975	1023	2950	1713	4663
Mtn. Rivers to:																								
Kazakh SSR																								
Kyrgyz SSR																								
Total																								
Local flow to:																								
Kyrgyz SSR										5	1	6	56	16	72	77	22	99				138	39	177
Industry & mun.																								
Kyrgyz SSR										6	6	12	25	25	50	1	1	2				32	32	64
Basin Total	183	64	247	44	7	51	779	77	856	1322	549	1871	1050	240	1290	1131	171	1302	48	975	1023	4557	2083	6640
Totals:																								
Kazakh SSR							83	18	101	295	111	406	176	25	201	938	121	1059	48	975	1023	1540	1250	2790
Kyrgyz SSR	183	64	247	44	7	51	696	59	755	1027	438	1465	874	215	1089	193	50	243				3017	833	3850

5. The diversion volume for the Kyrgyz SSR is set at 247 mln.cu.m for the reach upstream from the Ortokoi reservoir, and at 51 mln.cu.m for the Ortokoi-Gilaryk reach, including a diversion of 37 mln.cu.m from the Chu channel and 12 mln.cu.m from the Chon Kemin river.
6. The Gilaryk-Tokmak and Tokmak-Chumys flows shall be allocated during the reporting periods (monthly, 10-day and five-day periods). The diversion volumes must not exceed the figures shown in Table 3.

Table 3. Diversion Limits

Reach	Republic	Growing Season (Apr-Sep)		Non-growing Season (Oct-Mar)		Annual	
		mln.cu.m	%	mln.cu.m		mln.cu.m	%
Gilaryk-Tokmak	Kazakh SSR	81	11	17	25	98	12
	Kyrgyz SSR	666	89	52	75	718	88
	Total	747	100	68	100	816	100
Tokmak-Chumysh	Kazakh SSR	252	26	102	22	354	24
	Kyrgyz SSR	728	74	364	78	1092	76
	Total	980	100	466	100	1446	100

In the Gilaryk-Tokmak reach the rated water discharge is determined through the following formula:

$$Q = Q_{OPT} + Q_{CK} - Q_{PYCL} - Q_{TPAH3}$$

Where: Q_{OPT} = releases from the Ortokoi reservoir
Q_{CK} = water discharges from the Chon Kemin river
Q_{PYCL} = channel losses (channel decrements)
Q_{TPAH3} = transit discharge for the Tokmak-Chumysh reach

For the Tokmak-Chumysh reach the estimated water discharge is the sum of the discharge of the Chu river at the town of Tokmak and the discharge of intermediate inflow. The discharge of intermediate inflow consists of the Krasnaya river discharge, discharges of canals and tributaries to the Chu River, and also channel losses (channel decrements).

Intermediate inflow is determined through the following formula:

$$Q_b = Q_{CYM} + Q_{B3} - Q_{TOKM}$$

Where: Q_{CYM} = discharge from the downstream water of the Chumysh dam
Q_{B3} = total water diversion on a reach from the Chu river and from the Krasnaya river
Q_{TOKM} = discharge in the Tokmak section

7. In the Chumysh-Tashutkul reach (the Kyrgyz SSR) a permanent flow in the amount of 146 mln.cu.m shall be allocated to the Kyrgyz SSR from the Chu River.
8. Water distribution up to the allocated volume is implemented by each Republic as it sees fit.
9. Further development of irrigation in each Republic is allowed through the rational use of water within the volumes specified by the Provisions.
10. Flow allocation during a year (monthly, 10-day and 5-day periods) and an operation regime of the Ortokoi reservoir shall be established by the mutual decision of Ministries of Water Management of the Republics within the fixed annual limits.
11. With the enforcement of the above Provisions, the "Provisions on Water Allocation on the Chu River between the Kazakh SSR and the Kyrgyz SSR" of September 2, 1961 and also

Part I “Along the Chu River” of the Protocol of the par Commission of Councils of Ministers of the Kazakh SSR and the Kyrgyz SSR relating to the distribution of water resources of the Chu and Talas rivers between the Republics of March 26, 1976, lose their effect.

12. The flow allocation of the Chu river, in accordance with the Provisions shall be regulated by the Department for the Operation of the Kirov Canal in the Ministry of Water Management of the USSR (the inter-republic Division on flow allocations of the Chu and Talas Rivers between the Kazakh SSR and the Kyrgyz SSR).
13. Disputes arising between the Republics concerning water allocation issues shall be adjudicated by the above Department. All decisions of the Department are for compulsory execution by the Ministries of Water Management of the Republics.

Department of Water Resources “Glavvodresursi”	Department of Operation “Glavexpluatatsia”	Design “V/O Sojuzvodproect”
V. K. Adam	V. N. Alenin	N. E. Pesikom

(translation from original)

E.2 REGULATIONS
ON FLOW DIVISION OF THE TALAS RIVER

Ministry of Reclamation and Water Management of the USSR
Approved by
I.I. Borodavchenko
Deputy Minister of Reclamation and Water Management
USSR
January 31, 1983

Moscow
1983

Regulations on Flow Division of the Talas River between the Kazakh SSR and the Kyrgyz SSR are made based on the inter-republic division of river flow No. I/I-36-427 (428) set by the Ministry of Water Management of the USSR on April 27, 1981, which specified 50% for each Republic.

1. Water resources, which are accepted for division, are surface average annual flow of the Talas River and its tributaries, return flow and surfaced groundwater (less losses in the river channel and Kirovskoye Reservoir) of 1616 million m3.

2. Water consumption of the Kazakh SSR of 808 million m3 is provided by the releases of 716 million m3 from Kirovskoye Reservoir and the flow of 92 million m3 formed on the territory of the Republic. The measuring station in village Pokrovka downstream from water diversions of the Kyrgyz Republic monitors water amount released from Kiroivskoye Reservoir to the territory of the Kazakh SSR.

3. Flow distribution within a year (month, ten days, five days) and the operation mode of Kirovskoye Reservoir are established by a mutual decision of the Ministries of Water Management of the Republics, within specified annual limits.

4. Flow volume used by the Republics in a normal water year is ultimate. Flow exceeding average multiyear flow shall be accumulated in Kirovskoye Reservoir and used in dry years.

5. Regardless of water content of a year, water demands of industries and municipalities are satisfied completely.

6. Further development of irrigation in the Talas basin or increase in water availability may be carried out only within the share of flow allocated to each Republic by the Regulations and due to water saving from measures on technical improvement of irrigation systems.

7. Forced releases from Kirovskoye Reservoir made without preliminary assent of the Jambul Oblast Water Agency to receive water are not counted in water division calculations and are not subject to compensation.

8. As the Regulations are implemented, Regulations on Water Division of the Talas River and its tributaries, Konkol and Urmaral, between the Kazakh SSR and the Kyrgyz SSR of 1948-1949 and part 2 “On the Talas River” of the Protocol on Inter-republic Water Allocation of the Talas and Chu Rivers of March 26, 1976 (drawn up by the Parity Commission of the Councils of Ministers of the Kyrgyz SSR and the Kazakh SSR) become invalid.

9. Kirov Canal Operation Agency in the Ministry of Water Management of the USSR (inter-republic branch on flow allocation of the Chu and Talas rivers between the Kazakh SSR and the Kyrgyz SSR) monitors flow division of the Talas River in accordance with the Regulations.

10. Controversies over water division that arise between the Republics are settled by the specified Agency. Decisions made by the Agency are obligatory to be adhered to for the Ministries of Water Management of the Republics.

V.K. Adam	V.N. Alenin	N.E. Peskov
Glavvodresursy	Glavekspluatatsiya	Soyuzvodproject

E.3 1998 DRAFT of AGREEMENT

On the Principles of the Shared Recovery of Costs Associated with Operation and Maintenance of the Water Facilities of Interstate Joint Use

Between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan

The Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan, hereinafter referred to as the Parties,

Acknowledging the importance of mutual beneficial cooperation in the use of water resources formed on the territory of the Parties and the necessity of reliable and safe operation and maintenance of the water facilities of interstate joint use,

Aiming at the efficient use of water resources and water facilities for deriving maximum benefits by the Parties,

Recognizing the necessity to accelerate the development of the new water sharing strategy and economic cooperation in the area of use and protection of water resources and the shared water facilities,

Being guided by the standards of the international water law,

Have agreed as follows:

Article 1

Agreements regarding the issues of the use of river water resources, operation and maintenance of the shared interstate water facilities shall be targeted at the mutual benefits of the Parties on the fair and reasonable basis.

Article 2

Issues of water delivery, flow regulation, charged water use and allocation of benefits derived from the shared use of water facilities and water resources formed on the territory of the Parties shall be settled by the way of interstate negotiations and conclusion of bilateral and multilateral agreements on each river or the basin thereof.

Article 3

In the joint use of water resources from the shared interstate water facilities the Parties shall agree to recover the costs associated with operation, maintenance, capital repair and reconstruction of the facilities in proportion to the water received (share percent of each country).

Article 4

The Party-owner of the shared interstate water facilities has the right to receive compensation from the Party-user of the facilities for necessary costs to provide safe and reliable operation.

Article 5

The costs of the Parties incurred in operation and maintenance of the shared water facilities shall be assessed on the basis of the concerted calculations of the joint permanent water commissions, including the costs on study, registration and protection of water resources of each river or the basin thereof.

Article 6

The Parties shall undertake to observe the set calendar schedules of water delivery from the shared water facilities. Damages caused by the violations of the agreed schedules of water delivery shall be compensated except for the cases specified in Article 10.

Article 7

The Party-user of the shared interstate facilities shall recover its own share of costs within the agreed period. In the event of improper execution of obligations, the Party-user shall lose the right to receive water from the above facilities.

Article 8

The Parties shall undertake to carry out joint measures to remove the causes of the harmful effect of waters upon the water facilities and adjacent territories resulted from the natural cataclysms. The Parties shall also undertake measures aimed against floods, mudflows and other natural phenomena in the areas of the flow formation related to the rivers of joint interstate use.

Article 9

The Parties shall take share part in the carrying out of research, design and exploration work concerning the joint use of the shared water resources and water facilities, and also the prevention of natural cataclysms.

Article 10

In case of emergency at the shared water facilities caused by natural phenomena and technical reasons, the Party-owner of these facilities shall notify other Parties for joint actions to prevent, mitigate and remove consequences of emergency situations.

Article 11

The Parties shall acknowledge the necessity of the joint use of construction, repair, operation and industrial bases for the efficient use of water resources and the shared interstate water facilities.

Article 12

The Parties shall implement the order of unimpeded and customs free movement across the boundaries and territories thereof for staff, machines, mechanisms, raw stuff, materials intended for operation and maintenance of the shared interstate water facilities.

Article 13

In the event of arising disputes or controversies related to interpretation or application of the Agreement, the Parties shall settle them by negotiations. Any of the Parties has the right to initiate the consideration of these controversies or disputes in conformity with the standards of the international law.

Article 14

Upon the consent of the Parties addenda and amendments may be incorporated in the Agreement in the form of separate protocols. The addenda and amendments shall be an integral part of the Agreement.

Article 15

The Agreement shall come in force from the moment the last notification on the executed internal procedures has been deposited by the Parties.
The Agreement shall be valid sine die until the Parties decide otherwise.

Any of the Parties may terminate the Agreement by delivering the 6 months written notice to other Parties of its intention to terminate the Agreement.

Done _____________ (place) on ____________1998 (date) in one original copy in Russian.

The original shall be deposited in the office of the Executive Committee of the Interstate Council of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan. The Executive Committee shall deliver a certified copy of the original to each member state.

Government of the Republic of Kazakhstan,	**Government of the Kyrgyz Republic**	**Government of the Republic of Tajikistan**	**Government of the Republic of Uzbekistan**

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E.4 1998 DRAFT of AGREEMENT
On Joint Use of Transboundary Rivers, Water Bodies and Facilities

Between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan

The Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan, hereinafter referred to as the Parties,

Being guided by the agreements on the single economic space and on the eternal friendship between the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan,

Acknowledging the fact that the peoples of our countries have been living together for many generations and have been cooperating in issues of the joint and fair water use and water systems operation, therewith providing social and economic development of their nations and the welfare of the people,

Having the common aspiration to find the most perfect and equal solution in the joint use of water bodies and facilities of transboundary rivers in conformity with the international law,

Proceeding from the principles of neighborliness, equality, and mutual aid, declared their intentions to cooperate based on norms of the international law and
Agreed as follows:

Article 1

The Parties shall carry out coordinated actions to store and allocate water resources for efficient use thereof in boundary areas of the contracting Parties.

Article 2

Cooperation in the joint use of water resources, water bodies and water facilities is based upon bilateral agreements concluded by the Parties.

Article 3

The Parties agreed to adhere to the previous principles of proportional water sharing. The Parties shall take shared parts in repairs and rehabilitation of the bodies and facilities jointly used.

Article 4

To coordinate activities, two permanent commissions that consider and approve schedules of water releases for a next year, the operation mode of reclamation systems, and amounts of repairs and rehabilitation at the end of each growing season will be established bilaterally.

Article 5

The Parties shall undertake to annually budget funds needed for the joint operation of water bodies and facilities.

Article 6

The Parties shall undertake to carry out joint measures to remove the causes of the harmful effect of waters upon adjacent territories resulted from the anthropogenic influence. The Parties shall also undertake measures aimed against floods, mudflows and other natural phenomena.

Article 7

The Parties agreed to carry out research, design and exploration activities concerning the joint use water bodies and facilities.

Article 8

In case of emergency at the water bodies and facilities jointly used that is caused by natural phenomena and technical reasons, the Party-owner of these facilities shall notify other Parties for joint actions to prevent, mitigate and remove consequences of emergency situations.

Article 9

The Parties shall acknowledge the necessity of the joint use of construction, repair, operation and industrial bases to increase immediacy in the repair and rehabilitation activities on the water bodies and facilities jointly used.

Article 10

The Parties shall implement the order of unimpeded and customs free movement across the boundaries and territories thereof for staff, machines, mechanisms, raw stuff, materials intended for water management organizations.

Article 11

In the event of arising disputes or controversies related to interpretation or application of the Agreement, the Parties shall settle them by negotiations and consultations. Any of the Parties is entitled to initiate the consideration of these controversies or disputes in conformity with the standards of the international law.

Article 12

The Agreement shall come in force from the moment the last notification on the executed internal procedures has been deposited by the Parties.
The Agreement shall be valid sine die until the Parties decide otherwise.

Any of the Parties may terminate the Agreement by delivering the 6 months written notice to other Parties of its intention to terminate the Agreement.

Done _____________ (place) on ____________1998 (date) in one original copy in Russian.

The original shall be deposited in the office of the Executive Committee of the Interstate Council of the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan and the Republic of Uzbekistan. The Executive Committee shall deliver a certified copy of the original to each member state.

Government of the Republic of Kazakhstan,	**Government of the Kyrgyz Republic**	**Government of the Republic of Tajikistan**	**Government of the Republic of Uzbekistan**

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E.5 Protocol of the Meeting
on
Operation of Interstate Water Facilities
Jointly Used in the Chu and Talas Basins

Commissions of Water Committee in the Ministry of Agriculture,
Republic of Kazakhstan, and
Water Department in the Ministry of Agriculture and Water Management,
Kyrgyz Republic

11 March 1999
Bishkek

The Commissions authorized by Water Committee in the Ministry of Agriculture, the Republic of Kazakhstan, and Water Department in the Ministry of Agriculture and Water Management, Kyrgyz Republic, comprised of:

The Kazakh Republic	**The Kyrgyz Republic**
A. D. Ryabtsev, Deputy Chairman of Water Committee, Ministry of Agriculture, Republic of Kazakhstan	A. Kostyuk, First Deputy General Director of Water Management Department, Ministry of Agriculture and Water Management
Zh. Tukebaev, Chairman of Jambyl Oblast Water Committee	V. I. Bachevskiy, Head of Irrigation Systems Operation Board, Water Management Department
	A. G. Sizintsev, Chief Specialist of Irrigation Systems Operation Board
V. A. Sergeev, Head of Kordai Department of Water Management Systems	A. I. Isabekov, Head of BVO Chu
S. Bedelbaev, Head of Mobile Column Convoy-43	A. T. Sulaimanov, Head of Chu Canals and Rivers Administration

Considered the following issues:

2. Principles of operation of interstate water facilities jointly used in the Chu and Talas basins.
3. Shared participation of Water Committee, Republic of Kazakhstan, in repair and rehabilitation measures in 1998 to supply water to the Jambul oblast from interstate water facilities jointly used.

Agreed:

Water is supplied for the Jambul oblast due to the regulation of the Talas River flow in Kirovskoye Reservoir and of the Chu River flow in Orto-Tokoi Reservoir. After Orto-Tokoi Reservoir water is transported through the bypass Chu ferroconcrete canals from village

Bystrovka to the city of Tokmak, through the Big Chu Canals to the Chumysh water structure (on the Chu River) and through the Merkenskaya branch of West Big Chu Canal to the border of Merkenskiy rayon.

DECIDED:

Regarding the first issue

1. Attribute Orto-Tokoi and Kirovskoye reservoirs, bypass Chu ferroconcrete canals on the Chu River from Bystrovskaya hydroelectric power plant to the city of Tokmak, West and East Big Chu Canals with facilities, and the Chumysh water structure on the Chu River to interstate water facilities of joint use.

2. Determine the share of each Party in costs to operate interstate water facilities of joint use in accordance with agreed estimations and financial calculations done by competent agencies of the Parties. These costs include costs of operation itself, major repairs, and depreciation deductions for complete restoration of fixed assets, in proportion to amounts of water supplied.

3. According to the calculations by Water Department in the Ministry of Agriculture and Water Management, Kyrgyz Republic, preliminarily agreed with Water Committee in the Ministry of Agriculture, Republic of Kazakhstan, annual costs to operate interstate water facilities of joint use are $2.484 million. Of them, the share of Kazakhstan is $664,000.

Facilities	Total Costs Thousand $	Share of Kyrgyzstan		Share of Kazakhstan	
		Thousand $	%	Thousand $	%
Orto-Tokoi Reservoir	388	308	79.3	80	20.7
Bypass Chu Canals, West and East Big Chu Canals	1502	1319	87.8	183	12.2
Chumysh Water Control Structure	259	123	47.6	136	52.4
Kirovskoye Reservoir	335	71	21.3	264	78.7
TOTAL	2484	1821	73.3	663	26.7

Besides, as estimated by Water Department of the Kyrgyz Republic, investments necessary to assure safety and reliability of the water facilities specified, are tentatively:

Orto-Tokoi Reservoir	US$8.0 million
Kirovskoye Reservoir	US$2.0 million
System of Chu canals	US$4.5 million
Chumysh Water Structure	US$8.0 million

4. Water Department of the Kyrgyz Republic considers expedient to finance the costs shared by Kazakhstan in operation of jointly used water facilities through transfers to the accounts of Water Department.
   As a part of the shared participation it is allowed for Water Committee of the Ministry of Agriculture, Republic of Kazakhstan, to repair water facilities using its own capacities and funds within amounts of financing agreed with Water Department of the Kyrgyz Republic.

5. Water Committee in the Ministry of Agriculture, Republic of Kazakhstan, considers that, until related interstate agreements on joint use of water resources of the Chu and Talas rivers

are concluded and mechanisms for mutual settlements are set, the Committee will repair water facilities as a part of the shared participation, using its own capacities and funds within agreed amounts, work and facilities.

6. Both Parties initiate fastest preparation and conclusion of bilateral interstate (intergovernmental) agreements on the Chu and Talas rivers; for that they prepare and introduce draft agreements into their Governments.

7. Until interstate agreements are concluded, beginning from 1998 in October the joint commission of representatives from water organizations of the Chu, Talas and Jambul oblasts shall annually survey water facilities to define amounts and costs of repairs and costs of maintenance. The commission delivers its proposals to Water Department in the Ministry of Agriculture, Kyrgyz Republic and to Water Committee in the Ministry of Agriculture, Republic of Kazakhstan, before November 1 to approve operation schedules for the next year.

Regarding the second issue

1. Funds that have been allocated by Water Committee of the Ministry of Agriculture, Republic of Kazakhstan, for the past three years and work that has been carried out by the Committee itself cover only 20-30% of necessary operational measures on interstate water facilities of joint use. and cannot provide guaranteed water supply to the Jambul oblast in amounts agreed.

2. Water Committee of the Republic of Kazakhstan, having agreed it with Water Department of the Kyrgyz Republic, carries out the operational measures of 9.3 million tenge on Chumysh water structure and of 0.7 million tenge on Kirovskoye Reservoir before June 1, 1998 using its own capacities. The total is 10.0 million tenge.

3. Water Committee of the Ministry of Agriculture will take measures in accordance with domestic procedures of the Republic of Kazakhstan to provide financing for its share of agreed costs to operate interstate water facilities of joint use in equal parts quarterly.

For the Republic of Kazakhstan

A. D. Rybtsev
Zh. T. Tukebaev
V. A. Sergeev
S. Bedelbaev

For the Kyrgyz Republic

A. V.Kostyuk
V. I. Bachevskiy
A. G. Sizintsev
A. I. Isabekov
A. T. Sulaimanov

Received 2Dec99

E.6 Position of the Kyrgyz Republic on Maintenance and Operation of Joint Use Water Management Facilities

(The report of the Deputy Minister of agriculture and Water Management, Director General of the Water Management Department, A.V. Kostyuk)

State water resources issue is a corner stone in the economy of any country located in arid climate zone. Any country that implements irrigated agriculture experiences systematic water deficit and its demand grows into a big problem and makes the country dependent on water resources.

Constitutions of all countries make a statement that all natural, as well as water resources, located within the borders of the country, are the state property and are used in priority interests of the nation. The most generally stated/worded provision about this issue is in the 1803 UN resolution from 14 December 1962: "The right of nations and states to obtain inalienable sovereignty on their natural riches and resources should be implemented in the interests of their national development and well being of population of relevant states".

This sort of provisions have been included into all the CA constitutions that due to well known circumstances, have gained independence, including the Kyrgyz Republic.

The most part of the Kyrgyz Republic is under mountains that serve as atmospheric moisture accumulators. Run off of surface rivers that are formed within the boundaries of the Republic in an average annual water year are valued as 47,7m^3. Being a member of the former USSR, the Republic was always limited in its right to fully use its own water resources because of all national priorities that have been set up. In this particular case, the priority was economic water productivity and water was primarily delivered to places where it could yield high economic benefit. And the state compensated, to some extent, this loss that Kyrgyzstan has suffered.

The former USSR was split down and Kyrgyzstan has gained its independence. Now old priorities do not impact the country, but still no one compensates the country's past and present damages. The Kyrgyz Republic faces new problems, other priorities that are limited by legislation.

Among the initial and legislative provisions that Kyrgyzstan is following and that should be singled out are the following most important priority issues:

- the right of any state to exercise sovereignty and independence of the Republic on the entire territory marked by modern borders;
- to exercise full right to own all natural resources of the state, including water resources;
- to exercise the right to charge payments for use of natural resources, including water resources, both inside the country and on international level and using the experience and practices of the world communities. In establishing interrelations among entities to use water resources there may occur and sometimes spring up

problems and conflict of interests. Solution of these issues on interstate level is painstaking and requires certain attention and fair approaches. Limitation of activities and negotiation processes on interstate level is defined in the Law: "On water" and in the Decree of the President of the Kyrgyz Republic, A.A Akaev on: "About basis of foreign policy of the Kyrgyz Republic in the sphere of river water resources use, that are formed in Kyrgyzstan and flow out to territories of neighboring states".

Such kind of rivers, that are mentioned in the Decree, constitute the important part of the country's natural resources and are recognized as historical heritage and national wealth in public conscience. In implementation of the state policy on the use of water resources of such rivers, it is deemed to proceed from the principles and provisions stated in the Decree and the most important among them are the following:

- agreements on the use of water resources issues should be aimed to be mutually beneficial and on a reasonable and an equitable basis;
- the Kyrgyz Republic proceeds from the provision that the state has an authority to use rivers' water resources on its own territory to get maximum benefit. Issues of water delivery, regulation of rivers' run off and water payments or distribution of benefits from the use of water resources are the topic for interstate negotiations;
- The Kyrgyz Republic that is exercising regulation of run off and delivery of water to the states located in the down stream of the river, has the right to compensate construction, reconstruction and operation expenditures for reservoir facilities and other hydro technical facilities that are of interstate significance.

On the eve of sovereignty, the CA Presidents approved a logical and rightly worded decision, which meaning is the following:

- old Provisions about division of water resources from Kyrgyzstan territory sources, from where neighboring countries directly received water, does not correspond to current reality;
- to reach standard and generally accepted good neighborly water relations among riparian sovereign states, it is necessary to develop new principles of interstate water relations when relevant agreements may be signed between economical entities of the states;
- Taking into account that development of new sources is time consuming, it would be expedient, for that period of time, to extend the validity of old provisions, approved during the Soviet time, on water use.

In 1998 the Kyrgyz side submitted the draft of the "Agreement between the Government of the Republic of Kazahstan, the Government of the Republic of Kyrgyzstan, the Government of the Republic of Tajikistan, the Government of the Republic of Uzbekistan about cooperation on shared use of water facilities, water resources and water management facilities" and this document was delivered through Interstate Council to member countries. But on 18-20 June meeting of experts this issue was removed from the agenda and it was reasoned that "… taking into account and in compliance with 5 item of priority action Program of the Republic of Kyrgyzstan, the Republic of Kyrgyzstan and the Republic of Uzbekistan on establishment/forming economic cooperation area for the year 1998, the sides will conduct interagency meetings in the 3 quarter of 1998 and before September 1998 will submit a coordinated draft of the "Agreement about principles of sharing operation and technical maintenance compensation cost of interstate water management facilities” to the upcoming session of the CAEC Government Heads.

This issue was initiated by the Kyrgyz side at the August 1998 meeting of MKVK but then the participating countries assured that after additional studies their versions would be submitted. In September 1998 the Kyrgyz side officially submitted the above mentioned draft of the Agreement through the Interstate Council to be coordinated and viewed by experts, although at the 6-7 May 1999 experts’ session, the views of Uzbekistan experts were given special attention and the draft of the “Agreement between the Government of the Republic of Kazahstan, the Government of the Republic of Kyrgyzstan, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan about principles of sharing operation and maintenance compensation cost of interstate joint use water management facilities” was cancelled/removed from the agenda.

Thus, it turns up that, deliberately or unconsciously, but namely development, coordination and official approval of basic principles are groundlessly delayed. Agreements based on these principles are not reached. All this results in Kyrgyzstan huge economic losses and damages from water releases that our neighbors need so much. The Kyrgyz Republic believes that improvement of interstate water relations is issue N 1 and solution of this issue requires solution of legal issues as well. The Ministry of agriculture and water management, proceeding from current legislation should implement, on the level of CAR Executive Heads, the development and coordination of basic principles and mechanisms in the solution of interstate water relations, including joint use operation and maintenance water management facilities. While developing principles of water relations with other countries, it is necessary to take into account the following aspects:

- water delivery to the territory of the neighboring state through a water course/canal should be primarily performed on the basis of bilateral interstate agreements;
- agreements should highlight average multi year run off amounts and terms of water delivery, as well as interest shares for efficient water division in case of water level changes;
- the state, that performs water deliveries to another state through a river course or to a water management facility, is authorized to get compensation costs proportionally to amounts of delivered water;
- compensations should be performed in financial assets, as well as in converted currency and, only in the last resort other ways, it should be in compliance with the agreement reached between the sides.
- Water delivering republic and water consuming republic have various amounts of revenues from water resources due to their climate, soil and relief features and conditions.

Humane logic prompts that any physical, legal persons/entities, as well as, the state that uses services of other individuals or states, including water delivery, should compensate certain operation and maintenance costs of water management facilities.

Let’s make a more detailed analysis of water management joint use facilities. It should be emphasized that we have accumulated initial experience in establishing relations between the Kyrgyz Republic and the Republic of Kazahstan.

1. Over 90% of run off formed on the territory of the Kyrgyz Republic have hydraulic links with neighboring countries' river basins and run on their territories either on the surface or underground. About 10% from the total run off (or 4,65 km^3) are formed in the basin of the Issyk-Kul. All water reaches that feed the Issyk-Kul lake are formed on the territory of Kyrgyzstan and do not have surface communication/links with other river basins both on the territory of Kazahstan and beyond its borders. There is not any joint use water management facilities in this basin.
2. 6,64 km^3 of water resources are formed in the basin of the Chu river, including 5 km^3 on the Kyrgyzstan territory and 1,64 km^3 on Kazahstan territory. In the basin all water resources operation costs are distributed in the following proportions:
   58% - the Kyrgyz Republic
   42% - the Republic of Kazahstan.

   Joint use water management facilities in the basin of the Chu river include the following:

- Orto-Tokoy water reservoir on the river Chu which capacity is 470 mln.m^3
- Concrete-ferrous Chu off take canal which run off capacity is 42 m^3 /sec and the length is 40 km.;
- Western and Easter Big Chu canals with the capacity of 55 and 40 m^3/sec. relatively and the total length on the Kyrgyzstan territory is 200 km.;
- Chumish hydro-engineering complex on the Chu river to provide water in take for the Atbashy canal for Kyrgyzstan and the Georgievsky canal for Kazahstan.

3. 1,616 km^3 of operation water resources are produced in the basin of the river Talas (not counting the Kurkureuy-Suu and Bakair rivers) that are equally distributed between Kyrgyzstan and Kazahstan (50% for each). The Kirov water reservoir on the river Talas, which capacity is 550 mln m^3 is a joint use water management facility. Kyrgyzstan takes 22% of the run off from the Kirov water reservoir and Kazahstan takes 78% from the regulated run off.

4. The following mutual relations have been established between the two Republics concerning issues on operation and maintenance of joint use water management agencies of the Chu and Talas river basins:

- During the last three years protocol decisions directed to develop procedures and mechanisms to finance operation and maintenance cost of joint use water management facilities have been approved at the meetings of the first deputy heads of the Republican water management bodies' commissions;
- In particular, the list of joint use water facilities and interest rates of water obtained by each Republics from each facility have been coordinated. to Implementation operation costs for joint use facilities should be split between the republics proportionally to the amounts of water received;
- No mechanisms how to transfer assets from one country into another have been identified on the level of water management bodies. Instead, Kazahstan water management bodies performed repair works on the Kirov hydro-engineering complex in the Talas region/oblast, in the ???? (?) and the Chumish hydro-engineering complex in the Chu oblast using their own labor force and assets and compensated only1/5 of the required standard costs.

5. 27,4 km^3 of water resources are formed on the territory of the Kyrgyzstan, in the basin of the Syr Darya river, from this amount 4,88 km^3 or 18% are distributed to Kyrgyzstan in compliance with the USSR Ministry of Water Management protocol (see memo that corrects these data). The rest of the run off goes to Uzbekistan, Tajikistan and Kazahstan territories. Among the major joint use rivers are the two largest rivers – the Naryn river with an average 11,6 km^3 multi year run off and the river Kara Darya with 3,5 km^3 and also some left side and right side in flows of the Syr Darya. Among them are – the river Ak-Bura, Aravan-Say, Isfairam-Say, Shakhimardan-Say, Sokh, Isfaram, Khodja-Bakirgan, Maily-Say, Padsha-Ata, Kasan-Say and others.

The following water management facilities could be considered as joint use facilities in the basin of the Syr Darya: the Big Namangan and the Left side Haryn canal, the Papan water reservoir, Kassan-Say reservoir, the Right side Kampir-Ravat canal, Savay canal, ? ? ? (?), Pakhta-Abad, the pumping stations "Drujba" and ? ? ? (?), the pumping station "Khodja-Baqirgan" and other smaller water management facilities.

The basic principle of joint use water management facilities operation and maintenance based on the world experience is: participation of consumer-states in sharing compensation of water costs to supplier states for maintenance, depletion protection, contamination, protection of populated areas and other facilities from harmful/unhealthy water impact, for operation of hydro-engineering facilities and constructions, as well as sharing reimbursement of losses and damages affiliated with interstate water relations. Implementation of this principle within the system of definite agreement relations is

achieved though mutually coordinated adoption of all type of costs and losses for each of water facility and water management construction that constitute mutual interest, and also amounts expressed in monetary terms, that do not depend on annual water levels. The order of defining and accounting costs, damages and losses may be limited through jointly developed and coordinated methods/technique.

The outlined principle of sharing compensation cost is proportional to received water resource share and should be implemented proportionally to average size of annual profits received from water and energy facilities by one Side and from the use of this facility for irrigation purposes by the other Side.

The Kyrgyz Republic due to water limitations that were exercised during previous decades and having perspective possibilities to expand its irrigation agriculture to the amount of 1 million hectare, cannot provide its population by food and will be forced to develop irrigation farming. This will definitely cause increase of consumption of water resources on its territory.

To sum up this short survey we offer to discuss, in compliance with the agenda, the following types of water delivery compensations:

a) for joint use operation and maintenance of water management facilities, including cost of payments to the staff, performing current and capital renovations, as well as providing technical services;
b) for amortization of water management facilities, in compliance with established standards;
c) for annual damages from loss of agricultural products caused by land floods and floods in reservoirs' lands, lands designed for canals and other water management facilities;

d) for liquidation or reduction of damages caused by snow melting floods and seasonal mountain torrents in downstream states caused by regulated river run off performed in the upper stream state;

e) for costs to implement water resources monitoring in the zone where the joint use river run off is formed (e.g. hydromet services costs etc.);

f) for costs to preserve river run off formation zones (forestry cultivation, prohibition of economic management activities, creation of sanitary protection zones, etc.)

g) for costs that the republic suffers in joint use rivers caused by water releases flood;

Alongside with this, joint use water management operation and maintenance facilities should be performed/implemented by each owner - state independently and the maintenance costs, at the expense of water consumers, should be proportional to the received water share resources.

If the further solution of consumer-states’ shared participation to reimburse/compensate interstate joint use operation and maintenance costs is ignored, this will ultimately lead to conflicts caused both by technical reasons, such as: decrease of safety and stability that will result in accidents in big water reservoirs and other hydro technical facilities where millions of people reside and by economical and political reasons. Henceforward, the Kyrgyz Republic cannot bear responsibility for all these issues and pay all facility operation costs when other countries obtain benefits from this. Similar requirements concerning a number of facilities may be addressed to our Tajik and Uzbek friends, but they should be shaped quite definitely and should be mutually acceptable. This is the main goal to develop and approve the Agreement.

At the end I’d like to cite some numbers. Our calculations show that to provide standard measure requirements to jointly operate interstate facilities of the Kyrgyz Republic, the costs will amount to US $25,0 mln., not counting costs for reconstruction and technical renovation. From this, the share of:

Kyrgyzstan - US $10, 4 mln. - 41%
Kazahstan - US $1,9 mln. – 7,6%
Uzbekistan - US $12,7 mln. – 50,0%
Tajikistan - US $0,26 mln. - 1,)%

In reality only 1/5 of these shares is allocated. In this very difficult situation we are forced to withdraw some final portion of budget assets designed for other internal use water management facilities and aggravate the irrigation fund and we are forced to attract foreign investments to the amount of $20,0 mln. during 1999 – 2001 to rehabilitate reservoirs, canals, bank enforcement and protection works. I can make the statement that if our neighbors and primarily water management bodies do not undertake adequate actions to reach the Agreement, and will not participate in compensation of costs, then we’ll not be able to guarantee water delivery from these facilities both for irrigation and technical, economic and every day usage. I expect mutually beneficial cooperation and comprehension in the solution of this issue with my colleagues and the EC Interstate Council active and their proper support.

Taking into account significant experience and knowledge gained by international practices in USAID, it will provide all possible supports to achieve mutually beneficial agreements. Thank you for your attention!

E.7 Proposal for Developing Methods of Defining Joint O&M Costs Of Toktogul and Uch-Kurgan Water Control Structures

Alexei Zyryanov, Head, Hydro-technical Service
JSC KyrgyzEnergo,
Kyrgyz Republic

Toktogul water control structure has a hydropower station (HPS) with the capacity of 1,200,000 kW and a multi-year flow regulation reservoir with the Active capacity of 14-billion m^3 and water surface of 284 k m^3 . The reservoir was built for efficient and comprehensive use of water resources for the needs of the energy sector and irrigation.

The water control structure has the following performance characteristics:

On Irrigation:

1. Guaranteed water supply of the irrigated lands located in the Syr Darya basin on the area of 800 thousand hectares;
2. Water supply of additional lands on the area of 480 thousand hectares;
3. Guaranteed water supply equal to 19.5 billion m^3 instead of 15.0 billion m^3 of the central part of the Syr Darya basin on the area of 800 thousand hectares.

On Energy:

1. Guaranteed power capacity of the HPS equal to 260,000 kW;
2. Power generation equal to 4,400 million kWh;
3. Annual use of the installed capacity equal to 3,650 hours.

The design of Toktogul water control structure provided for the following breakdown of investments for irrigation and energy: 63% for irrigation, and 37% for energy production.

Thirty-one thousand nine hundred hectares of land were used for the construction of Toktogul water control structure of which 28.4 thousand hectares were used for the reservoir itself including 12 thousand hectares of arable land of which 10.7 thousand hectares were irrigated. According to some specialized institutes, yields from the lands used instead of the flooded areas comprise less than 50% of those that were gathered before.

Beginning from 1995, the Agreement between the Governments of the Republic of Kazakhstan, the Kyrgyz Republic, and the Republic of Uzbekistan provided for the rational use of the Syr Darya basin water resources stored in Toktogul Reservoir for satisfying irrigation needs in summer period. During the last 5 years (1995-1999), Toktogul Reservoir has been used for annual regulation and water supply of neighboring republics in the amount of 11-14.5 billion m^3, of which only 1.6 billion m^3 (an average for this period) is used for mutual exchanges of energy resources.

For providing additional volumes of water resources from the reservoir in summer, the neighboring republics have to accept power generated at the HPS, which must be compensated through providing energy carriers in the volumes equivalent to water resources necessary for power generation in winter. However, mutual energy transfers between the republics do not provide for compensation or allocation of O&M costs of water control structures.

Intergovernmental agreements between the Kyrgyz Republic, the Republic of Kazakhstan, and the Republic of Uzbekistan on the use of water and energy resources of the Syr Darya basin also do not provide for any compensation supplies for major water volumes released from Toktogul Reservoir during growing and non-growing seasons.

In our opinion, methods of cost allocation on O&M of Toktogul Reservoir must take into consideration the following factors and proposals:

- Water volumes provided for neighboring republics for satisfying irrigation needs;
- Power (kWh) provided and additional water volumes;
- Water volumes of the reservoir for seasonal and multi-year flow regulation;
- Compensation supplies for regulation and damage caused for the area where the reservoir is located;
- Actual O&M costs for the previous year, as well as planned for the next year;
- Activities scheduled for providing safe operation of the water control structures.

Uch-Kurgan water control structure with the reservoir of daily regulation and water surface of 4 m^3 , provides for regulation of water releases in accordance with the irrigation schedule. It has the following performance characteristics:

On Irrigation:

- Actual capacity of the daily regulation reservoir is 16 million m^3 ;
- Two irrigation water outlets from the reservoir with water flow under "UMO BNK" equal to 61 m^3 /sec, and "LBK" – 18 m^3 /sec;
- Re-regulation and water supply of the lower reach of the HPS in accordance with the irrigation schedule;
- Additional irrigated lands equal to 45 thousand hectares.

On Energy:

- Installed capacity of 180 thousand kW;
- Annual power generation of 820 thousand kWh.

It is proposed to take into account the following costs and compensations in the methods of cost allocation:

- Cost of water withdrawals from the reservoir to irrigation canals;
- Compensation for less power generated due to water withdrawals for irrigation;
- Power losses due to restrictions on the use of peak capacities during re-regulation of the flow;
- Water volumes supplied for irrigation through the HPS;
- O&M costs.

Annexes

1. Total Annual O&M Cost of Toktogul and Uch-Kurgan Water Control Srtuctures fo Joint Use (Report for 1998)
2. Water and Energy Operation Mode of Todtogul Reservoir

3. Water Flow through Uch-Kurgan Water Control Structure

Annex 1

Total Annual O&M costs of Toktogul and Uch-Kurgan Water Control Structures of Joint Use

(Report for 1998)

Types of Costs	Toktogul Structure (1000 som)	Uch-Kurgan Structure (1000 som)	Total Costs
1. Basic productive wage	1400.0	233.4	1633.4
2. Social insurance deductions from the basic wage	476.1	79.4	555.5
4. Operation and maintenance o equipment	41,545.3	6,924.2	48,469.5
4. Departmental overhead	4,545.9	757.6	5,303.5
5. Structure overhead	30,373.4	5,062.2	35,435.6
Maintenance (items 3,4,5)	9,215.6	1,539.9	10,755.5
Capital Repairs:	7,094.9	1,182.5	8,277.4
Buildings	141.0	209.0	350.0
Water facilities	4,315.0	652.8	4,967.8
Equipment	2,638.9	320.7	2,959.6
Total Costs	77,991.4	12,998.6	90,990.0
Tangible costs	16,325.0	2,720.8	19,045.8
Industrial work and services	7,624.4	1,270.7	8,895.1
Supplies	6,696.4	1,116.2	7,813.6
Combustible and lubricating materials	1,866.5	311.1	2,177.6
Energy	136.7	22.8	159.5
Wages fund	8,989.9	1,498.3	10,488.2
Social insurance	2,737.5	456.3	3,193.8
Fixed assets depreciation	23,448.4	3,908.1	27,356.5
Other costs and contingencies	26,490.7	4,415.0	30,905.7
Supplementary costs			
Medical insurance (2%)	179.5	29.9	209.4
Employment fund (1.5%)	134.7	22.5	157.2
Effluent charges (emissions)	35.4	5.9	41.3
Total Costs	78,341.0	13,056.9	91,397.9
Flood Zone compensation contributions	16,800	---	16,800
R&D	1,650.0	300.0	1,950.0
Hydrological and meteorological data	36.0	---	36.0
GRAND TOTAL	96,827.0	13,357.0	110,184.0

Annex 2

Water and Energy Operation Mode of Toktogul Reservoir (1995-1999)					
Item	1995	1996	1997	1998	1999 (anticipated)
	Inflow to Toktogul Reservoir (billion m^3)				
Annual	10.89	13.75	10.83	14.49	13.70
Fall and winter	3.09	2.8	2.96	2.58	3.24
Growing period	7.88	10.99	8.09	11.5	10.93
	Releases from Toktogul Reservoir (billion m^3)				
Annual	14.62	14.60	13.68	11.16	12.95
Fall and winter	8.3	7.8	8.36	7.12	7.94
Growing period	6.33	6.23	6.08	3.68	5.12
Additional amount	2.30	2.27	2.27	0.66	1.51
	Transfer of Electric Power Generated through Extra Releases from Toktogul Reservoir				
Total	1710	2072	2325	958	1453
Kazakhstan	782	995	710	469	483
Uzbekistan	928	1077	1615	489	970

Annex 3

Water Flow through Uch-Kurgan Reservoir

Month	Water Structure Releases				
	Total m^3 /sec	Through HPS m^3 /sec	To Irrigation Canals		
			m^3 /sec	Million m^3	Underproduction (million kWh)
Sept 1998	306.5	256.5	50	129.6	9.26
Oct	363.68	328.68	35	93.74	6.70
Nov	442.53	413.53	29	75.17	5.37
Dec	563.32	554.32	9	24.11	1.72
Jan 1999	645.45	642.45	3	8.04	0.57
Feb	555.61	551.61	4	9.68	0.69
Mar	557.55	540.55	17	45.53	3.25
Apr	504.07	487.07	17	44.06	3.15
May	356.68	316.68	40	107.14	7.65
Jun	350.67	305.67	45	116.64	8.33
Jul	500.58	444.58	56	149.99	10.71
Aug	446.77	384.77	62	166.06	11.86
Total	---	---	---	969.76	69.26

E.8 Review of the Proposal of Constructing an Operation Model for Kairakkum Reservoir

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At present, the work over the construction of optimization models to use water and energy resources in the Syr Darya basin has been started assisted by the EPIC Program. At the initial stage, individual models "River", "Energy", and "Planning Zone" are constructed. Within the first of the listed models, specialists of the Republic of Tajikistan (G. Petrov and S. Navruzov) proposed to develop an operation model for Kairakkum Reservoir.

Kairakkum Reservoir is known as one of the five major reservoirs on Syr Darya that enabled having regulated virtually all flow of Syr Darya. To consider operation of any of these reservoirs separately, out of operation of the entire cascade, is a violation of the single river principle. We can offer an optimal operation mode for an individual river reservoir. However, if it does not consider needs and demands of the whole water management complex of the river basin, nothing will come out of the introduction of such a variant – neither for an individual reservoir nor for the entire cascade. That is why the proposal of a model for Kairakkum Reservoir taken separately causes reasonable doubts. We should analyze available materials that are presented as a claim for future work.

We have considered two papers. The first is the article by G. Petrov and S. Navruzov "World Experience and Law in the Issues of Water Management of Reservoirs on Transboundary Rivers." This article contains the analysis of the legal basis for settling conflict situations arising between water consumers and water users in the light of modern political situation occurred in Central Asia after 1991. Views on possible alternative options of an operation model for Kairakkum Reservoir were presented in the other work of the same authors entitled "Syr Darya Basin. Water and Power Resources Use: Current Situation (National Sight of Tajikistan)."

Beginning the analysis of the works specified, let us remind the general principles of transboundary water use:

- Reasonable satisfaction of own daily wants with fair consideration of neighbors' interests;
- Interstate and interdepartmental interests should be coordinated not only with each other, but should take into consideration issues of sustenance for the most part of population in the river basin;
- Unconditional consideration of the common basin interests, and consequently the interests of the Aral Sea and Aral seaboard area;
- Water is a scarce natural resource, and if different approaches to its utilization by specific consumers are understandable; then water losses for the whole basin are at the same time unallowable, because such a situation leads to a disaster;

- River is a single natural complex, sharp violation of natural rhythms of which will eventually result in the lost environmental sustainability of a given ecosystem, what is unallowable;
- Maximum possible retaining of aims and tasks for each facility of the reservoirs cascade which were prescribed by the project and which took into account normal functioning of the cascade. Technical issues were solved from the viewpoint of river flow regulation, assuring environmental sustainability of water systems in the basin and coordinated operation of the entire cascade. The practice of last years showed that violation of project statements in general led to negative results: with particular and petty benefits in one place – to total losses and substantial negative consequences going beyond the activities of a given facility.
- Taking into consideration a current political situation in the region, settlement of conflict issues via negotiations, observation of the principles of the international water law, respect to neighbors, and aspiration for mutual beneficial cooperation.

The first work by Petrov and Navruzov is overloaded with a great number of quotations from documents of the international water law, the Energy Charter, and the Water Code of the Republic of Tajikistan. Legal sources, however, may be treated and understood wide enough. One thing is undoubtable in the reasoning of the authors – there is nothing eternal. For Central Asia, as far as we refer to changes in the political and economic situation during the last decade, we should assess the necessity to reconsider the order of transboundary water use and offer feasible solutions.

In this context, we cannot agree with mechanical division of the regional countries by interests, when Tajikistan and Kyrgyzstan are placed in one group, and Kazakhstan and Uzbekistan into another. Such division is rather conditional and may lead to false conclusions. Primarily, it is incompetent to equalize condition and positions of Kyrgyzstan and Tajikistan in the use of their reservoirs Toktogul and Kairakkum, because they are incompatible by scale and role in the Syr Darya basin. Toktogul is the biggest reservoir of the cascade and the major multiyear regulator of the river flow. Kairakkum is a seasonal, average-size and not the only channel reservoir on Syr Darya; there is still Chardara Reservoir approximately with same tasks as Kairakkum, only for the downstream as Kairakkum is for the middle course. Besides, if interests of Kyrgyzstan in the Syr Darya river basin are predominantly the generation of electric power especially in winter (the Kyrgyz irrigated areas are not vast), then we cannot say the same in respect to Tajikistan, because there are 185.3 thousand ha of the Tajik irrigated lands in the Syr Darya basin, most of which completely depend on the operation mode of Kairakkum Reservoir. Irrigation of these lands needs 65% of the water diversion allowed and approved for the Republic of Tajikistan by ICWC.

By the way, the allowed water diversion from the river, set and agreed for Tajikistan when ICWC was established in 1992, is by an order greater than the similar indicator for the Kyrgyz Republic – 2 cu km and 0.22 cu km for a water year respectively. Therefore, we should at once rebut the argument on which the authors of the proposed model rely as on an axiom that does not require evidence and is admitted allegedly by everyone: only the energy mode of Kairakkum Reservoir corresponds to national interests of Tajikistan… You know, on the specified Tajik lands live hundreds thousand people, whose existence hangs solely on irrigation. And if, as Petrov and Navruzov write, "under the critical shortage of electric power, especially in winter, the reduction of level of living and termination of the majority of social programs occur," then the reduction of water supply causes not only lesser crop on irrigated lands, but destruction of crop. Consequently, it leads people, whose sole occupation and source of life is farming, to a disaster. It is strange, but for some reason, the authors do not pay due attention to the fate of these people.

It is therefore difficult to agree with the interpretation of some references to judicial and legal documents, e. g. the Constitution of Tajikistan, which states that all natural resources are exclusive property of the state which guarantees their efficient utilization in the interests of the nation. What about the farmers of the Leninabad oblast? Since the authors decided without proofs that only the energy mode of Kairakkum is the most efficient for interests of the nation, so they treat the Constitution in a way they need.

A few more examples of the similar kind:

- Talking about the right of the country to establish an operation mode of the reservoir independently, proceeding from its own interests (as they are understood by the authors, we have already mentioned), the authors refer to Article 7 of Helsinki Rules, which states that " country of the basin cannot be deprived of the existing reasonable use of waters of international basin in favor of other country of the single basin for the future use of these waters". However, it is exactly in the work under consideration the authors propose to change the "existing use". Besides, Article 7 directly pertains to Uzbekistan and Kazakhstan, which will have a loss as a result of change in the existing use in favor of future use of these waters by Tajikistan.

- Referring to Helsinki Rules (Articles 4 and 5) the authors kind of agree with "reasonable and equal participation" of all water consumers in the use of transboundary waters, but already on the next page they declare Article 1 of the Agreement on equal rights to use water resources (February 18, 1992) a result of "the pressure of previous decisions."

- Citing the Water Code of the Republic of Tajikistan, where it is stated that "state ownership of interstate (transit) river waters is determined by the agreement of the countries in the river basins," the authors draw a conclusion that this statement concerns limits of water division, but not operation of reservoir. As to Kairakkum Reservoir, this is quite a poor example, because its operation, having been regulated by intergovernmental agreements between Uzbekistan and Tajikistan already for the second year, should be carried out in accordance with the mode of BVO Syr Darya.

- Interpreting the principle "don't damage", the authors say about a probability for an upside down situation and give the following example: "having banned Kyrgyzstan to draw down the increased consumption in winter, because this "damages" Kazakhstan, we make Kyrgyzstan to increase the shortage of electric power during the hardest period." In reality, the picture is more complicated, and many other harmful consequences are known: flooding of lands in the Republic of Uzbekistan and environmental consequences, loss of scarce water resources, reduction of water releases to the Aral Sea and Aral seaboard area. Besides, the situation may "turn upside down" not once: it is known that the practice of energy modes of Toktogul Reservoir steadily leads it to the emptying (high water growing season of 1998 temporarily helped), so what electricity will then be generated by the Naryn cascade in winter? It results in "damage" even for Kyrgyzstan itself.

We should remember that there is one more aspect of the problem – ecological sustainability of natural systems of the Syr Darya river basin. It is known that violation of natural rhythms leads to grave consequences and the Aral Sea problem is anything but the only example. The energy operation mode of reservoirs results in the alteration of seasons; summer changes places with winter, and flood now occurs in winter. In the inartificial nature cycle in winter the river serves as a natural drain that diverts most pollution of soil and underground waters, including pollution resulted from human activities. However, now the channel is overfilled in winter, and it often dries in summer. The absence of ecological and especially sanitary releases creates a tense environmental and epidemiological situation in the basin threatening epidemics, which pass all bounds and you cannot hide from them behind the mountains. Such is one of the most serious consequences of the transition of Toktogul and Kairakkum Reservoirs to the energy mode.

In addition, in the materials under consideration we should note a series of factual inaccuracies which may be taken as common errors, if they do not range themselves in a chain of proofs in the favor of the version put forward. Let us give some of them from the article on legal issues:

1. The Almaty Agreement of February 18, 1992 was signed by water heads of all countries of Central Asia. The article, however, states that Tajikistan had nothing to do with the document, while on behalf of Tajikistan it was signed by minister A. Nurov.
2. There were not one but two intergovernmental agreements on rational use of water and energy resources between the Republic of Tajikistan and the Republic of Uzbekistan – for 1998 (signed by vice-premiers of the republics) and for 1999 (signed by prime-ministers, but not presidents).
3. On the first page of the article, the authors state that on Syr Darya there are two major reservoirs Toktogul and Kairakkum. This is a blunder repeated not once. What place is allocated to Chardara Reservoir that has active capacity three times exceeding that of Kairakkum and carries out seasonal regulation of the Syr Darya flow downstream?

There are more inaccuracies of the kind in the second material.

Finishing the analysis of the article on world experience and law in the issues of water management of reservoirs on transboundary rivers, we should say that the idea of the authors is revealed only at the end of the article. Repeatedly citing legal and diplomatic documents and constantly mentioning reasonable and fair use of transboundary water, they eventually come to a simple and peremptory conclusion, "Any country has the UNCONDITIONAL right to establish ANY regime for a reservoir owned by the country consistent with national interests. In the event, if the regime affects interests of other basin countries, the country-owner of the reservoir shall modify the operation regime of the reservoir as agreed, with being provided with corresponding compensations."

As we see, prior citations are forgotten, and the rules of international water law barely cover the unconditional right of the owner. However, other countries may rely on this law. If we could pay no attention on those who are downstream, then what is to be done with the upstream ones? Especially if they hold similar views. You know that the river is single, and interests of all countries and departments have twined so tightly, that establishing ANY mode on a reservoir you own having UNCONDITIONAL right means to bite the hand that feeds you (*Russian "to chop the branch on which you are sitting").*

Now let us look how such a modification of the reservoir mode corresponds to national interests of the country – owner of the reservoir, and the most important thing, what alternative the authors offer in their model and what consequences its implementation may result in.

* * *

In the paper “Syr Darya Basin. Water and Power Resources Use: Current Situation (National Sight of Tajikistan)” a very disputable provision on the only possible way for Tajikistan to use transboundary waters of Syr Darya is again put in the basis of reasoning as an argument accepted by everyone. So the authors say on page 4, “the issues of irrigation, considering its subordinate role.” It is obvious that all other reasoning are adjusted to the solution already found. Again, the authors repeat the information about two major reservoirs on Syr Darya, not considering the existence of Chardara. Such abecedarian blunders are inadmissible. The authors declare that Kairakkum carries out main seasonal flow regulation for irrigation as if there is neither Fergana Valley nor the downstream for them (p. 13).

Further on, another information appears, “the water sharing limit fixed for Tajikistan was very insignificant as compared with other Republics – in the order of 1.5 – 2.0 billion m^3 per year but this volume was supplied at any annual water availability” (p. 5). The authors either do not know how the limits of the republics were justified in the design “Scheme”, or they try to create a false impression about “deprived” Tajikistan that can be relieved only through the transition to predominantly energy-oriented use of the Syr Darya water resources. Meanwhile, the limit of water diversion justified for each country considering irrigated areas, crops pattern and other features is 2.0 cu km for a water year for Tajikistan (not 1.5-2.0 cu km).

One inaccuracy makes another one, and as a result, the authors declare on page 9 that relations between energy and irrigation have not changed after 1991. This is also a blunder, because the functioning of Kairakkum Reservoir since 1992 have been essentially reconstructed owing to the transition of the Toktogul water structure to the energy operation mode. Consequently, at present there is already no irrigation mode of Kairakkum Reservoir, but there is the irrigation and energy mode (see Figure 1).

At that in the non-growing season, water releases from the reservoir are higher than in the growing season; weighted averages for 1992-1999 are 10.0 and 7.7 cu km respectively (for a water year). Thus, Kairakkum Reservoir in the non-growing season has virtually been switched to the energy operation mode, and vegetation releases somewhat decreased (Figure 1). It is not clear then what the authors are achieving by their proposal. In many respects, it is explained by the fact that operation of Kairakkum is considered without taking into account the operation of the whole cascade.

Further familiarization with the second article shows that, as it turns out, having kept and strengthened the energy component of the reservoir operation, the authors propose to reduce the irrigation component in the growing season to nothing. So it states, “…one more operation mode of the Kairakkum reservoir is the electric power regime meeting the national interests of the Republic best of all since it ensures the largest electric power output in winter being the most deficit period. At this regime the reservoir is filled up in summer, the growing season, and is completely drawn down in winter, the non-growing season.” In reality, it is impossible to implement this mode, at least in winter, because of the operation of Toktogul Reservoir.

It has been already said how such a mode will affect irrigated lands of Tajikistan (of course Uzbekistan and Kazakhstan as well) in summer. However, it is of interest to assess its consequences even if hypothetically, having combined it with the real conditions under which the Naryn-Syr Darya cascade operated in 1993-1999 and having assumed that Kazakhstan and Uzbekistan do not provide compensations. When the reservoir is being filled in the growing season, the shortage of water diversions occurs in the middle course of Syr Darya, excerpt for high water years. This shortage leads irrigated agriculture to a crisis.

On the other hand, losses of the Syr Darya water sharply increase in the non-growing season. Drawdown amounts of Kairakkum Reservoir also discharged to Arnasai Depression (Table 2) are added to these losses, because of impossibility to deliver these amounts to the Aral Sea and Aral seaboard area. Therewith, it happens that discharges to Arnasai under that mode will always exceed releases to the Aral Sea and Aral seaboard area (see Figure 2), i.e. the violation of common basin interests is present. The analysis of the introduction of the mode shows that the following events occur:

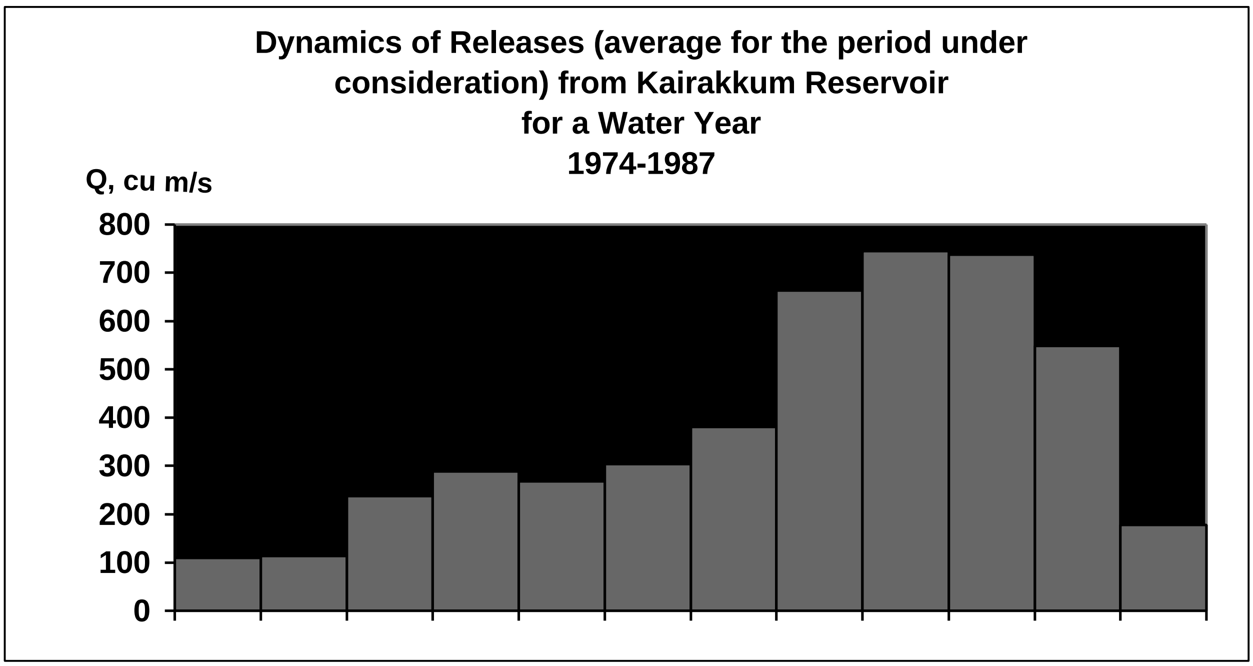
- Shortage of irrigation water in the middle course of Syr Darya for irrigated lands of Kazakhstan, Tajikistan, and Uzbekistan;
- Sharp growth of irrevocable water losses discharged to Arnasai Depression, and the loss of this water for the Aral Sea and Aral seaboard area.
- Loss of sustainability of the ecosystems in the Syr Darya basin, because of the lack of water downstream from Kairakkum Reservoir in summer and the flooding of the river bottomland in winter.

The authors of the model under consideration realize inadmissibility of such events; therefore, they raise the question of compensation by Uzbekistan and Kazakhstan to retain irrigation releases from the reservoir in summer. However, it is then necessary to estimate what amount of releases the republics specified should compensate. We cannot agree with the calculations given in the article, since they practically do not consider the pattern of actual use of the water released by Kairakkum. Actually, we should deduct the Toktogul releases already paid by Uzbekistan and Kazakhstan and water diversions of the Tajik irrigated lands in the middle course from the volume released in June-September. The residual volume can be negotiated in respect to compensations. In the calculations there is also a factual inaccuracy – effective storage of Kairakkum Reservoir equals not 2.6 cu km, but 1.7 cu km. We repeat that the authors' reasoning about the transition from the irrigation mode to the energy mode (p. 17) are erroneous –releases from Kairakkum in fall and winter have been higher than that in the growing season for already six years.

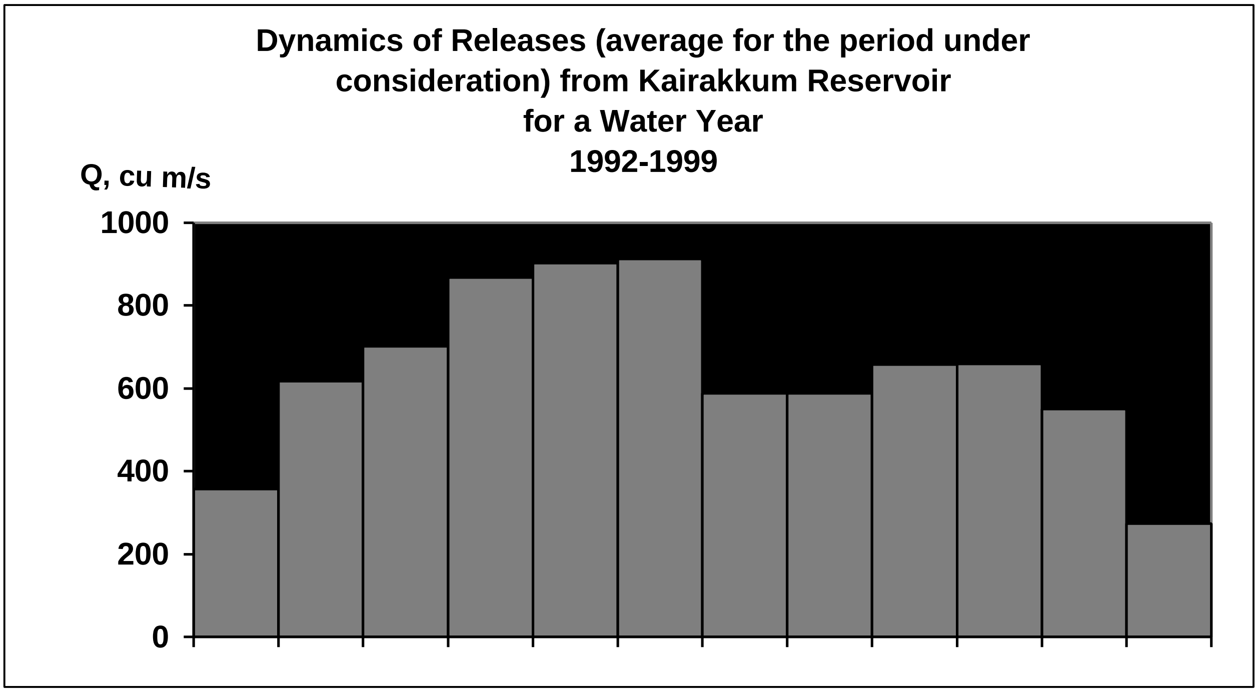
At last, we should discuss the following consideration. It is known that the Kyrgyz Republic receives compensation from Uzbekistan and Kazakhstan for the water released from Toktogul Reservoir in excess of the amount used by the hydroelectric power station to cover own electric power needs of Kyrgyzstan. This approach, however, is not taken into account in the model under consideration. For the period of 1990-1998, the Kairakkum hydroelectric power station annually generated about 323 million kWh on average in the growing season. This figure accounts for about 15% of the electric power consumption in the Leninabad oblast, that is the total generation of the Kairakkum hydroelectric power station goes to meet own needs of the republic. Consequently, water that is released from the reservoir and that generates electric power should be paid by irrigated agriculture for the second time. Is there a similar practice in the world water management? Obviously, we should fix a proportion that would consider this entwinement of interests.

The authors say about the damage, which the Republic of Tajikistan sustains because of the retaining of the irrigation mode of Kairakkum, though that mode has not existed in the pure form since even 1992. However, justice requires to assess other actual damages occurred as a result of the modified reservoir mode and those we have mentioned above.

The proposed model in no way consider coordinated actions among all reservoirs of the Naryn-Syr Darya cascade, giving saliency to the role of Kairakkum, which cannot function out of the cascade as a whole. That is why it is impossible to develop an optimization model for a separate reservoir of the cascade.



Time Frame	Average Monthly Releases (cu m/s)											
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
1974-1987	109	114	237	288	268	303	381	663	745	737	549	178



Time Frame	Average Monthly Releases (cu m/sec)											
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
1992-1999	357	617	702	868	903	913	589	588	658	659	551	274

Table 1: Some Operation Parameters of Kairakkum Reservoir In Implementation of the Proposed Model

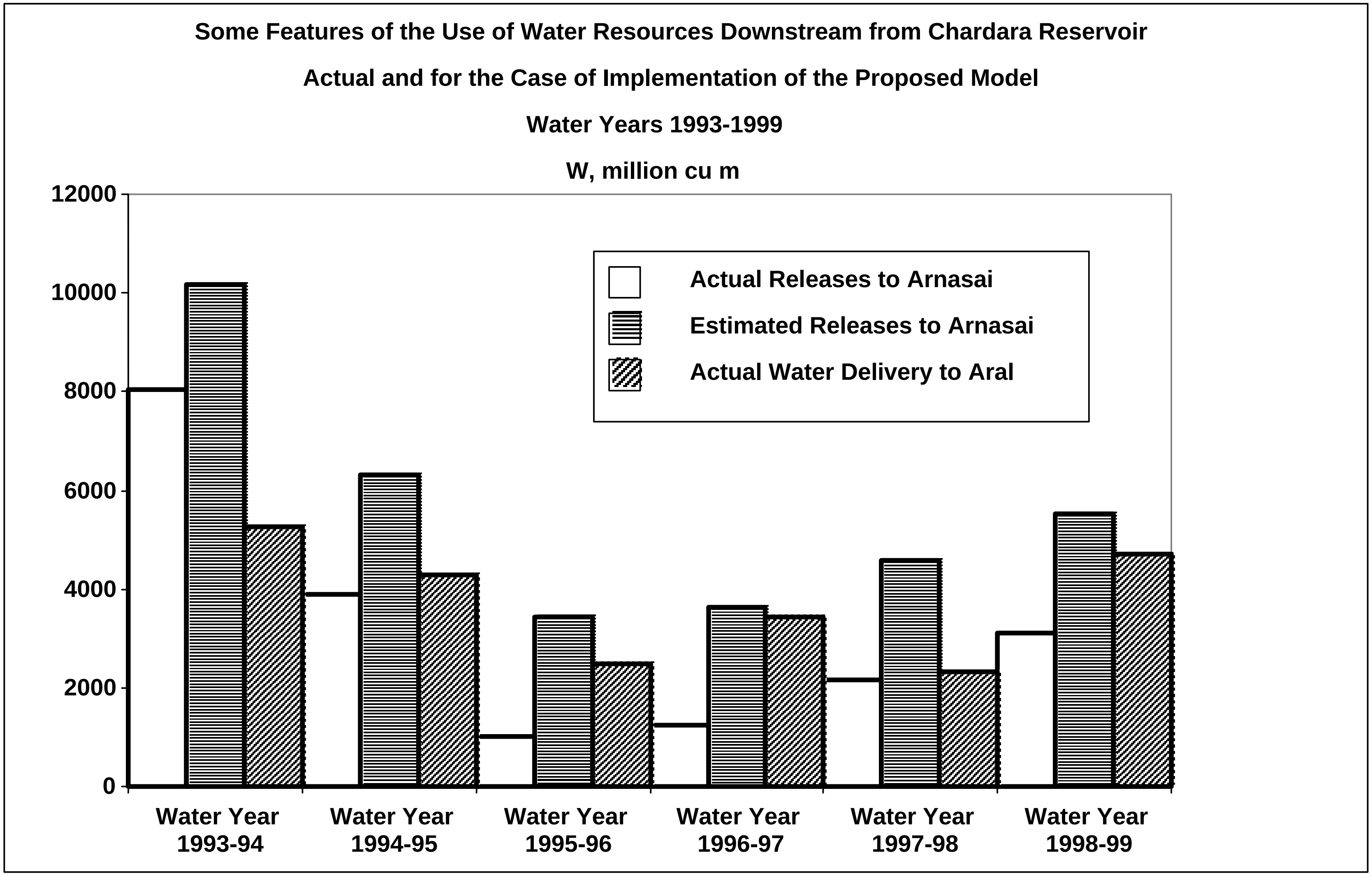
Growing Season (1994-1999)

Years / Parameters		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Volume of Kairakkum Reservoir at the Beginning of the Period, million cu m		1000	1000	1000	1000	1000	1000
Idem at the End of the Period, million cu m		3418	3418	3418	3418	3418	3418
Storage Volume of Kairakkum Reservoir, million cu m		2418	2418	2418	2418	2418	2418
Releases from Kairakkum Reservoir, million cu m	Actual	10801	6601	8396	6422	9912	8877
	Estimated	8383	4183	5978	4004	7494	6459
Shortage of Water Diversions in the Middle Course of Syr Darya, million cu m		-	2600	820	2800	-	500

Table 2: Some Operation Parameters of the Channel Reservoirs of the Naryn-Syr Darya Cascade In Implementation of the Proposed Model

Non-growing Season
(1993-1999)

Years / Parameters		**1993-94 Water Year**	**1994-95 Water Year**	**1995-96 Water Year**	**1996-97 Water Year**	**1997-98 Water Year**	**1998-99 Water Year**
Volume of Kairakkum Reservoir at the Beginning of the Period, million cu m		721	3418	3418	3418	3418	3418
Idem at the End of the Period, million cu m		1000	1000	1000	1000	1000	1000
Evacuation Volume of Kairakkum Reservoir, million cu m		2119	2418	2418	2418	2418	2418
Releases from Kairakkum Reservoir, million cu m	Actual	12353	12146	10586	12454	10657	12794
	Estimated	14472	14564	13004	14872	13075	15212
Discharge to Arnasai Depression, million cu m	Actual	8056	3901	999	1227	2159	3095
	Estimated	10175	6319	3417	3645	4577	5513
Actual Water Delivery to the Aral Sea and Aral Seaboard Area, million cu m		5260	4275	2473	3425	2337	4706



Some Features of the Use of Water Resources Downstream from Chardara Reservoir
Actual and for the Case of Implementation of the Proposed Model
Water Years 1993-1999
W, million cu m
12000
10000
8000
6000
4000
2000
0
Actual Releases to Arnasai
Estimated Releases to Arnasai
Actual Water Delivery to Aral
Water Year 1993-94
Water Year 1994-95
Water Year 1995-96
Water Year 1996-97
Water Year 1997-98
Water Year 1998-99